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CLEAN AIR

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ENVIRONMENTAL SECRETS

The Royal Commission on Environmental Pollution focussed once again in their 10th Report on the issue of confidentiality. "Secrecy fuels fear" says the Commission, making many detailed suggestions and recommendations for improving public access to information on emissions while at the same time ensuring proper safeguards to protect genuine trade secrets. This is a highly topical subject in the context of a national campaign for freedom of information. But how much do the public really want to know about emissions? The Royal Commission considers the public to be increasingly better informed on pollution issues, ready to challenge the sanctity of official data and less willing to take on trust the assurances of the control authorities.

Certainly when people feel personally and adversely affected by nearby industries, there will be calls for specific details of emissions, and demands that both industry and the authorities be accountable to the public. It may take the efforts of a determined local activist to mobilise community feeling to the point where elected representatives feel pressured enough themselves to advocate disclosure of information. Or it may be the case that data is revealed and presented with the best will in the world, but not received in that spirit. That is a risk run by the authorities in many areas of their work: whatever their efforts, they may still be scorned or their motives may be impugned.

There is really nothing so arcane or sacred about pollution data that their revelation should be such an issue. For 10 years, water authorities have been quietly publishing details of their water sampling results. One WA is quoted in the Royal Commission's report as saying: "Once any initial excitement has died down, then the general absence of confidentiality and the general availability of information should allay public fears and diminish criticism."

One thing is required: a knowledge amongst the public of rights to information (once the rights exist), and a basic understanding, fostered at all levels from primary school upwards, of the causes and effects of pollution. Ah, there's the rub. For when our best scientific minds find it difficult to decide exactly what part that well known old horror, sulphur dioxide, has in the process of acidification, what hope is there for us poor mortals, the public?

ATMOSPHERIC MAGNETIC MONITORING

Professor F. OLDFIELD and R. MAXTED
Environmental Advisory Unit, Department of Botany, University of Liverpool

Abstract

Measuring the magnetic properties of iron oxides provides a new basis for erosion, sedimentation and particulate pollution monitoring. Atmospheric, aquatic and soil systems can all be studied by these techniques. Mineral magnetic measurements use rapid, simple sampling methods, and portable equipment provides on site analysis. The measurements are non-destructive, safe and quick. They allow particulates to be quantified and characterized in many environmental contexts.

Rationale

Iron oxides are ubiquitous in the environment and are amongst the most sensitive of all compounds to chemical and thermal change and to the environments within which these changes take place. Both natural processes such as soil development, and anthropogenic processes such as fossil fuel combustion, produce a number of particulate iron oxides which are strongly magnetic, chemically stable and have magnetic properties diagnostic of their source and mode of formation. These 'mineral' – magnetic properties are quite distinct from those which record the nature of the earth's magnetic field (Natural Remanent Magnetisation) since they are a function of the mineralogy of a sample as measured in artificially generated fields. It is possible to establish the type of oxides present and hence categorize the magnetic mineral assemblage by means of its magnetic 'fingerprint'. In many situations these magnetic oxides are intimately associated with heavy metals such as lead, zinc and copper, whilst characteristic fine grained secondary oxides are diagnostic of the clay fraction of soils.

Where heavy metal and magnetic analysis have been carried out on the same sets of leaf, filter or peat samples a close relationship between the two has emerged, reflecting the common sources of the magnetic minerals and heavy metals through processes such as fossil fuel combustion.

Techniques & Equipment

A whole new range of instruments and sensors have been developed by Bartington Instruments in conjunction with Liverpool University. Some can measure the magnetic susceptibility of surfaces, sections and exposures, other serve as down-holes probes, core scanning loops and single sample sensors for both wet and dry materials. Recent advances make it possible to handle any material from whole peat or sediment cores of any length, to filter paper samples. The equipment is light, battery or mains operated and small, making on-site surveying and monitoring very easy.

Complementary to the magnetic susceptibility system is a second range of equipment comprising a pulse magnetizer and magnetometer manufactured by Molspin Ltd. As presently developed it can be fitted into two suitcases but it is still portable and self-powered. This can quantify both the type and concentration of iron oxides in a sample by applying a strong magnetic field and then measuring the remembered magnetic signal or 'remanence' when the field is removed. This is known as Isothermal Remanent Magnetisation (IRM).

As all the equipment is portable, on site sampling and measurements are possible, conferring a high degree of flexibility in surveying and monitoring. Sampling and field characterization of cores can be undertaken at a rate of 5 – 25 cores per day and single samples at 50 – 100 per man per day. As measurements are non-destructive at all stages they are repeatable and samples can be used subsequently for other types of analysis, e.g. dating using radioactive carbon, lead and fallout Caesium-137. The data obtained from both types of equipment can be treated statistically and are easily mapped using a wide range of techniques.

Background

A whole range of atmospheric pollution measuring techniques have been developed as the need for monitoring has increased as a result of statutory or other requirements.

Studies have generally followed one of two lines. Several employ direct measurements using devices such as Ringelmann charts, gas bubbling and various smoke filter systems. In general such systems directly measure only *relative* pollution levels. The filters are expensive and whilst precise, the equipment is usually too delicate and expensive to risk in long term monitoring programmes in inner city areas. Indirect measurements have utilized a number of biological indicators, most notably lichens. This work was pioneered by Gilbert and he was able to point to a number of important indicator species. However, considerable expertise is needed to distinguish lichens at a species level and their value is seriously limited at high levels of pollution. The present note is designed to introduce a new approach using magnetic measurements. Many industrial and especially fossil fuel combustion processes discharge particulates with a magnetic component. Moreover, trace metals are frequently strongly enriched in the magnetic fraction. The present methods are designed to measure magnetic concentrations as well as variations in magnetic mineralogy. There are three major areas of application for magnetic monitoring: single source output tracing, area surveys, and historical analysis.

Methods

Magnetic techniques can be used to measure atmospheric pollution by examining the rate and type of deposition of iron oxides on a number of surfaces, e.g. peat bogs, filters, and leaves. Leaves provide ideal, natural, contemporary depositional surfaces for particulate iron oxides. It is best to use a single widely distributed species such as Rosebay Willowherb or Sycamore. They can be sampled by using 10 ml sample holders to cut discs from the leaves and thereby retain a constant surface area for measurement.

Some 50 leaf discs can be packed into each sample holder. The samples can be analysed for both the concentration and the nature of the magnetic minerals present using portable magnetometers and susceptibility meters. No further preparation of the sample is needed. Each sample takes some 5 - 10 minutes to retrieve and measure using parameters such as total susceptibility, quadrature susceptibility, Isothermal Remanent Magnetization (IRM) and Coercivity of IRM, $(Bo)_{CR}$. This means that surveying of large areas can be undertaken quickly. A second technique is to use cling-film collectors stretched over wire frames. These are then collected, packed into a standard sample holder and measured.

Peat cores have been used to assess the historical input of anthropogenic particulates from the atmosphere. The method works well where chronological control is sufficiently detailed to allow reconstruction of peat accumulation rates as they vary in response to changes in climate, hydrology and vegetation cover. Ombrotrophic bogs (i.e. those which have grown up above the water table to become entirely dependent on atmospheric inputs) preserve a record of changing magnetic spherule deposition and hence particulate output especially from fossil fuel combustion and metal processing industries. Cores of peat can be measured using the loop attachment of the Bartington Susceptibility Meter and a wider range of measurements can be carried out on subsamples from each slice. All the measurements are rapid and non-destructive.

By using present day leaves and cling film traps surveys can be undertaken to pinpoint areas of high pollution or else to trace the output from a single source. A survey has been undertaken which used the leaf techniques to assess particulate pollution levels in West Yorkshire. Samples were taken for magnetic measurement at the National Survey of Air Pollution sites. The best estimates of varying concentrations were obtained from IRM measurements. These ranged widely with a background level of $20 \times 10^{-3} G\ cm^2$ across the whole area. Above this a number of concentration levels were established which appeared to reflect both source proximity and topography. Peak values occurred in urban valley sites such as Halifax. In addition, variations in the type of iron oxide present were examined by measuring the coercivity of IRM in each sample. All the samples fell within a narrow range of coercivity values and the full demagnetization spectra were characteristic of a magnetic mineral assemblage dominated by magnetite (Fe_3O_4). This was closely comparable to the magnetic mineral assemblage sampled by Hunt using cling film collectors in the Mersey Tunnel. A number of impactor gauges were set up in and around the tunnel and the type of material, trapped in different size ranges, was analysed. On the basis of his measurements, roadside particulates could be distinguished from Power Station Fly Ash in which a relatively higher haematite (Fe_2O_3) content is recorded for all size fractions. In each case the magnetic 'fingerprint' was quite distinctive which confirms that it is possible to trace individual sources where the output can be analysed and its signature established.

These techniques can thus provide a simple framework for rapid *in situ* surveying, for comparative and longitudinal studies and for source tracing. To the magnetic measurements can be added any number of subsequent more complex radiometric and chemical analyses. The data obtained can be readily treated statistically and cartographically using a wide range of techniques. Many common industrial particulate pollutants can be

monitored magnetically e.g. from smelters, refineries, power stations, and iron and steel works. The technique could also be used to measure pollution arising from automobile emissions.

Chronological surveys using peat cores have been undertaken at over 50 sites in N.W. Europe and in North America in connection with major nationally funded research projects. In all cases, there is a major increase in particulate iron oxide loading during the 19th and 20th centuries as a result of anthropogenic output in recent times. The spatial variations in total atmospheric input reflect proximity to major individual sources such as power stations, smelters and iron mines, and to major complex sources such as industrialized conurbations. The chronology of magnetic deposition faithfully reflects the history of activity in each source area. Even in the remotest areas of Finnish and Norwegian Lapland there is a significant 20th Century increase in magnetic deposition. Both spatially and temporally within the peat record there is, at British sites, a strong and direct positive correlation between magnetic concentrations and heavy metal values.

Conclusions

From the work carried out at Liverpool and by co-authors at other universities it is clear that the use of mineral magnetism can confer a number of advantages in terms of time and spatial scale in many monitoring programmes. From a common theoretical base it has been possible to develop a wide range of techniques which, in turn, have a growing range of actual and potential applications.

The ease, speed and simplicity of most of the sampling methods, combined with the accuracy, safety, speed and repeatability of the measuring techniques allow very large, comprehensive surveys to be undertaken over very short periods of time. The portability of the equipment, combined with rapidity of the techniques, makes possible pilot or emergency surveys of short duration whilst the quantitative and source specific nature of the information provided will often furnish a sound factual basis for process monitoring and for impact evaluation.

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COMPUTERS HELP AIR QUALITY MANAGEMENT

Dr Bob Pocock*

We must all have wondered at some time or another whether the new 'age of information technology' will really help us to solve the problems that our professions exist to solve, or whether it just means that we must dream up problems in order for it to solve them!

One subject however where the benefits of better information technology are now becoming clear and unambiguous is air pollution. A combination of technical and legislative circumstances indicate that, at least so far as smoke and SO_2 are concerned, computer-based modelling is now coming of age. The basis for this view emerged from a stimulating one-day seminar organised by the Warren Spring Laboratory and held at the Society of Chemical Industry on 14th November 1983.

The main themes that have combined to establish a new impetus to air pollution modelling are:

- the EC Directive on 'smoke' and SO_2;
- the concomitant shift towards an 'air quality management' approach to air pollution control;
- the DOE's anticipated review of the legislative basis of air pollution control and the prospect of a further, more formal, consolidation of the 'air quality management' principle;
- the need to quantify and systematically record and catalogue air pollution emissions as the basis for a managed approach to control;
- the need to look beyond the present and to anticipate future air pollution scenarios (eg consequences of development plans, new plant/closures of plant, changes in fuel use such as the possible increases in coal burn), in order to prepare anticipatory control measures;
- in terms of value for money, the need to supplement direct measurement with the results of models;
- the increasing availability of information technology systems and staff familiar with handling them.

* *Dr Pocock is an Associate of the Public Sector Management Research Group at the University of Aston in Birmingham, and an Associate Consultant to JURUE, a Division of ECOTEC Research and Consulting Ltd.*

On the evidence of the seminar, this whole bundle of pressures promises to generate a dramatic leap forward over the next few years in the use of computers as an aid to both the scientific basis and practical implementation of air pollution control. Lest this should seem a naively futuristic statement (with possible Orwellian undertones!) it must also be said of course that in the end, clean air costs money and that environmental protection will be advanced only to the extent that Local Authorities, Central Government and industry are willing (and able) to commit resources to it. The point here is simply that the possibilities now exist for a substantial improvement in the organisational and managerial efficiency in directing these resources, a development which in turn strengthens the 'political' credibility of environmental protection expenditure.

Dr Alastair Keddie set the scene for the seminar's morning presentation from WSL. With his usual crisp incisiveness he pointed to Local Authorities' responsibilities in respect of the Chimney Heights Memorandum and the EC Limit Levels/Guidelines and the associated needs, both for a knowledge of emissions and also for a model to relate emissions to environmental levels. Dr David Hall continued the theme by sketching out the difficulties of modelling in the real world, where a Local Authority typically has to look after a multiplicity of sources whose emissions are difficult to disentangle and attribute when experienced at the receiving end. Mr Roger Timmis took over at this point to describe the Laboratory's success in handling this kind of problem. In his view modelling was "an essential aid to decision-making in air quality management". Work had been carried out in Dublin with some considerable success. The measured levels of smoke and SO_2 had been allotted through an apportionment technique to each of six different types of source. This made it possible to determine which types of source were the most influential in different parts of the city. From this the most cost-effective control strategy could be devised. Further details of this interesting project are available in the Laboratory's publication LR440.

One further point of interest to emerge from this presentation concerned the most likely mode of infraction of the EC Directive in the UK. The Limit Levels in the Directive are expressed in three forms: (a) annual median; (b) winter median; and (c) the 98th percentile (ie the 7th most polluted day in the year). So far as smoke is concerned, WSL's statistical analysis of the day-to-day variation in UK smoke levels has indicated that the 98th percentile level (218 $\mu g/m^3$) is the most likely of the three parameters to be breached at sites in the UK. Computer models will therefore have to be able to predict the 98th percentile levels if they are to be of use in evaluating the EC Directive.

The afternoon session of the seminar opened with Mr Peter Burgess of the DOE's Air and Noise Division. In the Government's view one of the attractions of comprehensive modelling exercises was that they were a way of getting more information at less cost than by relying on measurement alone. On the question of the EC Directive, Local Authorities could expect to hear more from the Department soon on compliance with it. There was also a prospect of further guidance being needed on nitrogen oxides now that it looked likely that a Directive on this form of air pollution would also be forthcoming.

Middlesbrough Borough Council have set up what they term a 'sensible management'

approach to air pollution control, and Mr David Clark of their Environmental Health Department addressed the seminar on the application of this approach using a relatively simple 'box model' method.

This had been used by Mr Clark's Authority in deciding on its priorities for smoke control designation, and had helped them to tackle the assessment of the possible consequences of new industrial development when this was being considered at the planning application stage. Similar work had been done in connection with their Enterprise Zone. Mr Clark was, however, moved to confess a heresy: the 'sensible management' approach could also be used to identify areas with a pollution capacity — where conditions might be allowed to deteriorate, and therefore where one might seek to direct new polluting industrial development.

Mr David Bird of Sheffield City Council was next to the rostrum with an outline of the extensive programme of modelling work now being set up by his Authority. Their attitude in Sheffield was that modelling would positively advance the quality of the environmental protection service, and would not be just a cost-cutting exercise for reducing the amount of measurement. The modelling approach would allow the implications of new industrial development areas to be predicted, smoke control to be targetted in the most effective and efficient manner, the effects of possible fuel use changes would be assessed, and Environmental Impact Analysis could be carried out on industrial planning applications, new housing developments etc. They had chosen to purchase the USEPA UNAMAP software package of models for about £1300, this being in their view the best available modelling package although it required the use of FORTRAN language and therefore a relatively large computer costing about £10,000.

Rounding off the Local Authority contributions, the GLC's Dr David Ball used his cool and measured style to great effect in summarising the most extensive effort yet carried out in the UK to establish an inventory of air pollution emissions. He emphasised that an effective air pollution modelling and management exercise was predicted on a sound inventory of emissions and that in cost-effectiveness terms the bulk of the technical effort should be directed at building up a good reliable inventory. In the GLC they had used both desk surveys (involving postal questionnaire surveys of known industrial and commercial 'point' sources) and site visits to check out detailed technical information on the form and nature of SO_2 emissions. Area sources such as domestic and commercial area emissions were estimated using land use/floor space data and an apportionment technique based on sales data from the fuel supply industries. The survey had allowed some interesting secondary objectives to be pursued: the average energy use per dwelling for different types of property in London had been calculated, and a general map of 'energy use density' had been drawn up for the City. Some three man-years of effort had been given over to the emissions inventory. Dr Duncan Laxen would now be updating the inventory and extending it to other pollutants over the next two years.

Dr Henderson-Sellers of Salford University completed the day's presentations with a description of the progress being made in his Department in developing computer modelling software for Local Authority users. The Chimney Heights Memorandum

formulae were already available on disc and a simple diffusion model package was expected to be completed within the next 12 months.

Several further points emerged during discussion. Dr Keddie reported the possibility that WSL might consider marketing a computer air pollution modelling package to Local Authorities, but they were limited by the amount of 'back-up' service they could offer. One solution might be for DOE to finance a National Centre which would act as a database/information unit on the computer models available, hardware required etc. As regards inventory techniques, the Laboratory would consider issuing recommendations on the best techniques once an internal project on updating the inventories for the UK as a whole was completed in the next 12-15 months.

The overriding impression of this absorbing day remained that along with the new technologies, air pollution modelling – and with it the air quality management principle – has arrived and is here to stay. And air pollution control will be the stronger for it.

LETTERS TO THE EDITOR

Dear Editor

Oxfordshire County Council Act

This Authority is endeavouring to raise the financial limits contained in the present section of the above Act which gives the power to order the alteration of a chimney height upon a complaint to a magistrates court.

The section allows work to be done in pursuance of the order providing the expenditure does not exceed a certain figure, firstly in the case of a single private dwelling house, and secondly, in any other case.

It is considered the present limits are not realistic and this department is seeking, in a new Bill, to have them substantially raised.

I would be pleased to learn therefore of any experience other Authorities may have had with this legislation.

Yours faithfully,

A.J. Rees
South Oxfordshire District Council
PO Box 20
Council Offices
Crowmarsh, Wallingford

Dear Editor,

Lead in Petrol

I would have a lot more sympathy with Professor Scorer if lead was a natural constituent of petrol instead of something introduced in the technological search for speed and power. Why cannot we now admit that, like asbestos, it was a mistake to use it the way we did in the first place? In a country which taxes motor fuel to the extent that we do it is nonsense to imply that a copper or two on a gallon of petrol is too high a price for removing thousands of tons of atmospheric lead.

(Professor Scorer's "urban child", who "lost" three pigs on the way from market, would probably tell his mother it was due to lead poisoning).

A return to internal combustion engines which do not demand high octane fuel would be of long term benefit. Even Professor Scorer does not imply that high blood-lead levels do you good, but no doubt somebody will before long!

Yours faithfully,

G.R. Millington
Principal Assistant – Pollution Control
City of Wakefield Metropolitan District Council

DIVISIONAL NEWS

Northern Ireland Division

After a lapse of a number of years a meeting of the Division was held in the Reception Room of the City Hall, which was attended by 71 delegates, representing both members and officers of District Councils, officers of Central Government and representatives from the various fuel interests. It was pleasing that the meeting had generated such interest.

The meeting was opened by the Divisional Chairman, Mr. R. Campbell Brown, who invited Councillor Mrs. D. Dunlop to say a few words. Cllr. Dunlop, as deputy Chairman of the Health, Markets and Meat Plant Committee of the Belfast City Council, welcomed the delegates to the City Hall. She mentioned her own interest in environmental matters, and that she had been glad to be able to attend the recent conference of the Society at Torquay.

The Chairman then asked the Secretary General of the Society, Air Commodore John Langston, to address the meeting. Air Commodore Langston spoke briefly about the history of the Society and also about its involvement in the cause of clean air and more recently in other pollution problems such as noise, acid rain, lead and asbestos. He went

on to explain how the Society is organised in order to make best use of the resources available to achieve its objectives.

Following the Secretary General's address the Chairman introduced Miss Joyce Knight, formerly of Stranmillis College of Education. Miss Knight introduced an audio visual presentation which she had produced for the Learning Resources Unit of the College, on Air Pollution in Northern Ireland. This presentation is intended as a teaching aid which can be used in schools, and describes very clearly what the main air pollutants are, the effects of air pollution and the steps which are being undertaken in order to reduce pollution.

The Chairman thanked Miss Knight for such an excellent presentation and then invited questions from the floor which Air Cdre. Langston answered. Following this discussion period the meeting was drawn to a close at 4.00 p.m. by the Chairman, who thanked the City Council for its hospitality. Afternoon tea was then provided for those in attendance.

J.O. Hetherington
Hon. Secretary

West Midlands Division

Ironfoundry Lead Emissions – Report of the Meeting Held 31 January 1984

Heavy metal emissions from ironfoundry cupola furnaces was the subject of a meeting organised by the West Midlands Division on the 31 January, at the University of Aston. Those present included the Director of the British Ironfounders Association and representatives of BCIRA, the District Industrial Air Pollution Inspector, and Dr. R. Pocock and Mr. S. Simmons of Aston University. Amongst NSCA members present was Mr. Byrom Lees, who had been invited by the Division to open the discussion on estimated levels of lead emission from ironfoundry cupolas.

The problem of lead emission from this source in the West Midlands was raised in *Clean Air* by Steve Simmons, of JURUE, Aston University. Since the publication of that paper there has been much discussion within the Society about the accuracy of the estimated annual discharges of lead in cupola fume emissions. Speakers at the meeting generally agreed that the lead emissions in fume were at least an order of magnitude higher than the emissions in grit and dust, and were not insignificant when compared with emissions from road vehicles. Having considered the basis of calculations made by Mr. Byrom Lees and by BCIRA, respectively, the meeting decided that there was a real need to obtain more information about the situation, and that more measurements should be made of actual lead levels in air, dust, soil and vegetables in the area. Further, it was considered important to discover just how localised the environmental impacts of ironfoundry cupola emissions are, and to look at the practicalities of tightening controls on emissions.

The meeting resolved that a Working Party be established, under the chairmanship of

Dr. Pocock, and with the participation of members representing local authorities in the area. BCIRA is also prepared to consider giving its support. The Division and the National Society are most grateful to all those that took part in this important meeting, in particular the University of Aston, Dr. R. Pocock, Mr. Simmons, Mr. Lees, Mr. Shaw and Dr. Biggins of BCIRA, and Mr. Farrant.

The Society is also grateful for the efforts of Karen Sulway in responding so quickly to the Council's suggestion that the Division might hold a meeting on the subject. Mrs. Sulway has served as Secretary of the Division for the past four years, and both the Division and the Society as a whole appreciate her efforts during that period. She has now handed over to her successor, Mr. L.F. Medlycott, who is Principal Environmental Health Officer (Pollution Control) with the District of The Wrekin. Mr. Medlycott has served for a number of years as Hon. Secretary of the Midlands Joint Advisory Council for Clean Air and Noise Control, but will be relinquishing this office later this year.

BOOK REVIEWS

Tackling Pollution – Experience and Prospects. 10th Report of the Royal Commission on Environmental Pollution. *Pub HMSO, £10.75.*

The Royal Commission on Environmental Pollution's 10th Report was published on the 22 February 1984. (*NSCA News,* February 1984, outlined the Report's main findings, highlighting support for key points of NSCA policy.) The Report made 52 recommendations in a wide-ranging review of priorities for the future and action that is needed to combat new or growing forms of pollution.

Among the new technologies that might produce pollution problems, the Royal Commission identified the burgeoning electronics and bioengineering industries, particularly those involving discharges of organic compounds in trace quantities. Apart from such novel sources of pollution, the Commission warns that increases in industrial and domestic uses of coal and its conversion to substitute natural gas are potentially causes of a rise in future air pollution levels.

The report emphasises the increasingly international nature of environmental pollution and says that the UK should make a more positive contribution to the development of environmental policy within the European Community. The Commission also says that the UK should pay more attention to the potential hazards of substances which have persistent and bioaccumulative effects, and should place less reliance on the apparent ability of surrounding seas and prevailing winds to carry pollution away from the British Isles.

The last major review of air quality and monitoring conducted by RCEP was for their 4th Report, published in 1974. Noting the real improvements that have occurred in the decade since then, the Commission acknowledges that there are still local air pollution

problems, with some areas not yet complying with the EC Directive limit values for smoke and SO_2. However, although the Commission has been "made aware" by local authorities and other bodies, including NSCA, of the difficulties in ensuring that only authorised fuels are used in areas covered by smoke control orders, it has concluded that the magnitude of the problem is not great enough to warrant further legislation. This view is not shared by the National Society for Clean Air; our surveys of the illegal use of bituminous coal and other unauthorised fuels in smoke control areas have revealed a significant erosion of the credibility of clean air legislation in some areas, alongside a deterioration in air quality.

The Society has made it plain that the problem is at present confined to relatively limited areas, and manifests itself in different ways. However, many householders remain unconvinced of the calorific advantage enjoyed by solid smokeless fuel compared with bituminous coal, and are all too readily influenced by the price advantage enjoyed by coal over solid smokeless fuel. The result is that sales of bagged coal from corner shops are on the increase in some major urban smoke controlled areas. In other parts of the country, the problem is variously related to the concessionary coal allowances, the use of 'fuel for free' (seacoal), sales off the back of the lorry, or use of woodburning appliances.

The Commission has considered a number of specific air pollution issues: indoor air quality, motor vehicle exhausts, photochemical oxidants, acid deposition, stratospheric ozone depletion, and carbon dioxide and climatic change. It was obviously impossible to carry out a detailed study in each of these areas but the Commission has attempted to outline the problems and identify the key issues, and says that it stands ready to return to any of them when appropriate.

One new concept introduced in this Report is that of the "Best Environmental Timetable", or BET. Realising that the state of scientific knowledge of a pollutant, or the risks of damage entailed in its presence in the environment, often varies widely and yet that it is not always (or indeed often) possible to delay any response until there is scientific certainty, the Commission suggests that the concept of "Best Practicable Environment Option" should be reinforced by one of "Best Environmental Timetable". Once politicians or environmental managers consider that it is time to make the transition from evidence-gathering to policy decisions, BET would ensure that action is taken against the background of carefully planned programmes of pollution abatement, with targets set well in advance. The Commission's recommendation to introduce now a ban on straw burning, to become effective from 1989, is an example: farmers would thus be told in good time of the environmental requirements they would have to meet and would be able to make the necessary investment in alternative uses for straw.

The Commission argues in this, as it did in its 9th Report, that industry might be able to create competitive advantage out of higher environmental standards. Above all, the Report emphasises the need to act now, not later, in some areas, stressing the advantages of control measures which anticipate and forestall pollution problems. The Report rightly points out that in the long run prevention is usually cheaper than cure, and warns

that in some cases there may be a risk of creating intractable problems which no amount of "retrofitting" or "clean-up" operations can put right.

Indoor air pollution

The Commission concludes that, providing proper attention is paid to ventilation, indoor air pollution is not a serious problem. It finds little evidence of harm to health from exposure to emissions from cookers, fires and heaters at the concentrations usually encountered in the home. Tobacco smoke is an exception; smoking, says the Commission, introduces a number of contaminants which cause greater irritation and nuisance to most people than other sources of indoor air pollution. (The Commission draws a distinction in the Report between a "contaminant" and a "pollutant". The former term is used to refer "to the introduction or presence in the environment of alien substances or energy", but does not imply a judgement on whether they cause, or are liable to cause, damage or harm.)

Air Pollution Monitoring

The Report emphasises the need to strengthen the present arrangements, particularly for monitoring substances which contribute to acid deposition and photochemical air pollution. The Commission mentions criticisms of current arrangements for monitoring in relation to the EC Directive on Smoke and SO_2 (80/779/EEC). The wording of the Directive is, it acknowledges, open to interpretation, but the Report perches rather uneasily on the fence; neither wholly supporting nor thoroughly refuting the argument that kerbside smoke levels should also be monitored.

Vehicle emissions

Further to the 9th Report, the Commission now says that it is essential to adopt a route to the introduction of unleaded petrol which does not involve increased emissions of carcinogenic hydrocarbons. On diesel emissions, the Commission refers to the Department of Transport estimate that some 14 per cent of lorries emit excessive smoke – although police prosecutions number only 7,500 a year, compared to 14,000 for excessive noise and 391,000 for speeding offences. The Commission says that measures are urgently needed to combat excessive smoke from road vehicles; disappointingly, the Report does not advise tightening the standard of emission from new vehicles, but instead recommends that the Department of Transport should institute urgently a programme of research into the use of electronic engine control systems and other forms of engine technology to make the quality of emissions from diesel-engined vehicles less dependent on standards of engine maintenance.

The Commission says that greater urgency should be given to the development of more expeditious and objective methods for the measurement of smoke from diesel-engined vehicles, both at testing stations and at roadsides, and that legislative provision should be made to enable local authorities to take proceedings directly against operators of vehicles emitting excessive smoke.

Energy and Environmental Policy

The Commission calls acid deposition a major international problem, and says that urgent research should be carried out on its causes, effects and remedies. While accepting that the costs of substantial reductions in SO_x and NO_x emissions from power stations will be high, the Commission recommends that the CEGB should start to introduce the various abatement options now, on a pilot basis. The Commission has also considered the implications if the findings of research should show the need to make a major reduction in the use of fossil fuels.

The Commission warns that on present trends, increases in emissions of carbon dioxide could result in a 2^{o} C rise in global temperature in less than 100 years. Uncertainties surrounding the "greenhouse effect" should be resolved, and the highest priority should be given to appraisal of alternative energy scenarios in preparation for a possible progressive shift away from the use of fossil fuels. In that context the Commission controversially advocates a "modest" increase in nuclear power capacity. In answer to questions on this point at the press launch of the Report, Professor Sir Richard Southwood made it clear that the Commission does not support nuclear power development on a scale of one new station a year for the next 20 years, and that its views were in no sense intended to influence the outcome of the Sizewell inquiry.

In view of the need to relate decisions on energy policy to their environmental impact, the Report strongly recommends that the Commission on Energy and the Environment should be reconstituted, and expresses regret, also, at the passing of the Clean Air Council and the Noise Advisory Council. The Commission had considered "noise" as a possible subject for the next Report, but have decided instead to study wastes, including contaminated land.

Further Initiatives in Air Pollution Control in the European Communities

by Konrad von Moltke.

The Institute for European Environmental Policy has published an essay on Air Pollution Control in the European Communities, by Konrad von Moltke, in which he sets out the current situation and outlines possible further initiatives.

The author considers that the European Community will have a vital role to play in attempting to deal with the interregional transfer of air pollution. On the one hand, he points out, the Member States of the Community together are a major source of emissions and, more importantly, the Community's policy-making process is the most refined and intensive international forum of decision-making. The Community has a mandate to act to control air pollution, based not only on the action programmes and their subsequent elaboration and interpretation, but also on the Community's role in assuring compliance by the Member States with the Geneva Convention on Long-Range Transboundary Air Pollution.

The essay reviews currently available instruments for air pollution control and suggests

that further action may need to take a different direction than appears likely at present. In particular, the author argues that:

- it is highly unlikely that the Community will be able to define what constitutes best available technology or best practicable means;
- there will need to be a discussion of the costs of measures, and in particular of their proper attribution;
- the ultimate goal of pollution control will need to be addressed from the outset.

In order to provide a basis for debate on what may constitute reasonable levels of SO_2 emissions for EC Member States, the essay makes a calculation using the current Dutch emission reduction target of 30%. This suggests reductions greater than 60% for Belgium, the UK and Luxembourg, more than 50% for Italy, and over 45% for the FRG and Denmark. While these are only rough estimates, the thrust of the essay is to suggest that the Community may be better served by pushing for agreed reductions in national emissions of all substances considered problematical and giving greater consideration to the means of financing these, rather than focusing on the technical means to be employed.

"Further Initiatives in Air Pollution Control" can be ordered from: European Cultural Foundation, Jan van Goyenkade 5, NL – 1075 HN Amsterdam, The Netherlands. Payment of Nfl 6, by Eurocheque for bank transfer to – The European Cultural Foundation, Algemene Bank Nederland N.V., Amsterdam, Rek. No. 540 122 114.

Industrial Air Pollution, 1982 *(Health and Safety Executive)*

The 1982 report of the Industrial Air Pollution Inspectorate was published at the end of January. This is the first report to be issued under the Inspectorate's new name, and the Chief Inspector, Dr. Leslie Reed, mentions the "tinge of sadness" amongst the staff at the loss of their old title, which led to various inappropriate forms of address such as the "Alkaline Spectre"! A brief account of the Inspectorate's history is included in the report.

The report says that little has happened to change the overall impression of a depressed and demoralised industry, but some signs of increased activity, particularly in the cement and fertilizer industries, are noted.

Referring to the long standing problem spot for the Inspectorate as well as local residents – the Phurnacite plant at Abercwmboi – the report deprecates the decision of the Industrial Tribunal to modify the Notice served on National Smokeless Fuels by the Inspectorate. "First", writes Dr. Reed, "it appeared to place national agreement between firms and their unions beyond local variations as a means of securing environmental benefit, and second, it included the opinion that a works that was operating at a substantial loss could not reasonably be expected to incur additional expenditure on large items such as electrostatic precipitators."

The Inspectorate served altogether four Improvement Notices, all for a failure to meet best practicable means. All but the Notice served against National Smokeless Fuels Ltd. have since been complied with.

Inspectors undertook 20 prosecutions during 1982, seventeen of which were successful. The majority were, as in previous years, taken under Section 78 of the Control of Pollution Act for illegal cable burning (in future such prosecutions will be handled by local authorities). The other five also related to metal recovery operations and were for failure either to register or to use best practicable means.

The Inspectorate saw evidence of continued public concern for the environment in the 11% increase in complaints against registered processes, together with a 6% increase in the investigation of complaints against non-registered works (where the Inspectorate assists at the request of the local authority).

The report comments in detail on only a few specific industries: electricity, gas and coke, and petroleum works. Detailed accounts of the performances of various other works and industries are given in the reports of the District Inspectors which are available locally. However, the Chief Inspector's report contains a welcome review of uncontained sources of lead emission — a review which was urged by both the Royal Commission on Environmental Pollution and the National Society for Clean Air.

The Inspectorate has been concerned for many years to identify sources of uncontained lead emission, and devise appropriate control measures. Towards the end of 1981, a group of inspectors visited the 12 largest registered lead works to observe and compare current practices in the industry for the control of uncontained sources, and to discuss the various problems involved with the works' management. The object of the study was to obtain a critical and unified view of the problems and the practices being adopted and the outcome will be advice incorporated into the next revision of the *Notes on Best Practicable Means for Leadworks.* The review gives useful guidance on the handling and storage of raw materials, transfer operations and the handling of recycled materials, and provides examples of practices in process containment which appeared to offer the optimum controls available at present.

As local authorities recognise, the movement of materials by road within a leadworks, (particularly within stocking areas) can spread dusty materials quite widely. The more effective practices are summarised but the review notes that even if all practical precautions are taken, it is still necessary to ensure that vehicles leaving the works do not carry out lead-containing materials which can fall off onto public roads. Wheel-washing facilities have been installed at several works but the review Group noted that the three different types in operation all appeared to have disadvantages, including (in all three cases) the lack of a contained area for draining after washing. From their observations, the Group offered suggestions as to the make-up of a good wheel-washing facility, which would include coarse jets directed at an angle to sluice the wheels down on either side (and also the wheel arches), a water-filled trough for the tyres to run in, an irrigated exit ramp and draining off area using clean water which then drains back into the trough,

easy facilities for sludge recovery, and finally (and most important), no ready means of by-passing the wheel washer.

Research projects commissioned or undertaken by the Inspectorate included the dust and materials handling project, the precollection agglomeration scheme as an aid in fuel control, and the investigation of odours arising from coal carbonisation. In Bedfordshire, a programme has been agreed to carry out an environmental monitoring survey around brickworks. Harwell are to carry out a study of sampling and analytical methods for emissions from incinerators burning chemical waste, and the Meteorological Office are to carry out a programme of works, using mathematical modelling, to predict persistence of visibility of moisture-laden plumes for a range of stack gas and meteorological conditions.

Reviewing the use of emission standards in air pollution control policy, Dr. Reed comments upon the recent proposals put forward by the European Commission for the control of air pollution via the imposition of fixed or uniform emission limits. Dr. Reed generally supports the "framework" Directive – COM (83) 173 – which seeks to ensure that countries will have procedures to licence and approve air pollution controls on those processes most likely to create air pollution. His support is unsurprising, since in many respects that proposal is parallel to the existing arrangements in the UK, and many of the processes which would be covered by the proposals are currently controlled by IAPI. However, Dr. Reed effectively rejects uniform emission standards as an appropriate basis for EEC legislation, saying that unless they are widely adopted, they might not solve the problems of transfrontier air pollution.

Acid Rain: A Review of the Phenomenon in the EEC and Europe

This report, carried out by Environmental Resources Limited for the European Commission, examines the range of environmental damage that may be attributable to acid pollutant emissions, and assesses the sources of emissions, the mechanisms whereby they might cause environmental change, likely future trends in emissions, and the cost of alternative control strategies. The report is comprehensive and as up to date as it is possible to be, in view of the evolving knowledge about the causes and effects of the phenomenon. It is also clearly written and takes care to highlight areas of uncertainty.

ERL were also asked to suggest areas where further research work was needed; while making several recommendations, the authors of the report point out that postponement of control action until all the answers are known will probably lead to other, as yet unidentified and possibly irreversible, environmental damage taking place.

"Acid Rain – A Review of the Phenomenon in the EEC and Europe" is published by Graham & Trotman Limited and is available from Graham & Trotman or from good book shops at £12.50.

REPORT ON 50th NSCA CONFERENCE

Torquay, October 31 – November 3 1983

by Jane Dunmore

The Society's Golden Jubilee Conference drew some 300 delegates to Torquay at the end of October for an event which was designed as a springboard into the future rather than a reflection on past achievements. Some of the subjects covered, such as acid rain and major industrial hazards, will be debated for years to come, while other sessions tackled current controversies such as straw and stubble burning.

Presidential Address – Environmental law

One of the highlights of the week occurred on the opening night, when the Society's newly elected President, **Professor D.G.T. Williams,** delivered his inaugural presidential address. Professor Williams' academic interests lie in the fields of constitutional and administrative law and in recent years he has taken a particular interest in matters relating to the environment. He was a member of the Clean Air Council, of the Commission on Energy and the Environment and until recently of the Royal Commission on Environmental Pollution. His theme at Torquay was the role of legislation and the courts in responding to the needs of the citizen and securing environmental improvements.

Environmental law occupies a special and important position in the UK's legal system. Although many long-established rights under common law may be used to provide restitution to individuals affected by pollution, progress in tightening up controls has been largely by voluntary agreement, rather than as a result of judgements in court. Most distinguished observers of the scene, including the Royal Commission on Environmental Pollution, have held that persuasion and co-operation are preferable to an aggressive policy of confrontation through litigation. However, Professor Williams detected the beginnings of a change towards a more formal procedure, and perhaps more testing of the law in court.

The Audience at the Opening of Conference

Referring to fears that there could be increased litigation in the future over the impact of proposed developments, Professor Williams expressed the opinion that such assessments were certain to be required in one form or another, although whether or not the courts would be involved to any great extent remained to be seen. As to whether it was desirable for the courts to be more involved in environmental matters, he considered that such hearings provided the citizen with the means of ventilating grievances and frustrations, or lost confidence in other avenues of redress. This was not an argument for increasingly lengthy public hearings, in the

courts or elsewhere, but for the maintenance of a forum which could redress the balance against the large, complex, remote and highly centralised system of modern government.

Update pollution laws

Professor Williams thought it essential for laws on pollution to be up to date and accessible, to keep pace with the needs of the citizen or other interest groups. Statutory law had constantly to be related to administrative control, exercised through planning procedures and other informal processes at both central and local level. Above all, national laws had to be subject to frequent re-evaluation, in the light of international negotiations over matters of common and environmental concern.

He acknowledged the pressures on government, recognising the understandable temptation to shelve troublesome schemes for the consolidation and re-appraisal of laws. The ramifications of any environmental policy were so wide that government often had to commit itself to the demands of the moment rather than to an overview of the problems of energy, pollution, planning and the environment. It was easier to make immediate decisions about specific issues than to look at entire areas of environmental concern, such as clean air, and decide on an overall policy.

Hostages to fortune

One of the chief difficulties in forcing government to take such an overview was the reluctance of any administration to offer hostages to fortune in the volatile areas of environmental concern. Nevertheless, it was essential that government should ensure that there was constant monitoring of the environment and a series of mechanisms for offering advice or reassurance to the public.

Cost savers

In this respect, he felt that recently abolished advisory bodies such as the Clean Air Council, The Noise Advisory Council and the Commission on Energy and the Environment, had, because of their membership and remit, been able to take a broad view of their responsibilities which government alone could not supply. Independent advisory bodies could be cost-saving, in that they could help to clarify the broader policy issues at stake in major inquiries (such as Windscale or Sizewell). In the absence of such government-appointed bodies, the National Society for Clean Air continued its advocacy of all reasonable methods of securing a cleaner environment. Professor Williams concluded that the Society offered many of the advantages of official advisory bodies, remaining a very important model of how such bodies should conduct their affairs.

Shortfalls in control

Key points in The President's address — the role of legislation in securing environmental improvement, the need for government to take a broad overview instead of simply reacting to events as they occurred — were picked up in the presentation by **Mr. W.F. Snow,** on "Air Pollution Control in the UK". This paper represented a view from within the Society of air pollution control achievements to date and future needs. Mr. Snow, who is CEHO, Warrington BC, examined the basis of the improvements in air quality so far this century, and identified shortfalls in specific areas: in policy management, the framework for control, and in relation to specific pollutants such as acid rain, asbestos and noise. Mr. Snow's paper preceded a broad-based discussion on the future of air pollution control in the UK,

chaired by Professor Williams and with questions from the floor being fielded by Mr. Snow and spokesmen from the Department of Environment, the Confederation of British Industry, the Commission of the European Communities, and the Industrial Air Pollution Inspectorate.

The Panel of Speakers (Messrs. Martindale, Rutterford, Fairclough and Snow) with the Society's President, Prof. David Williams.

The discussion provoked some stern comment, by **Ivor Barker** of Sheffield City Council and **Byrom Lees** (Individual Member), on the failure to control long-standing and perfectly tractable problems: dark smoke emission (as permitted under the 1958 regulations) and grit and dust emissions from oil fired plant. **Stephen Carden** of Barnsley MDC referred to the problem of night-time burning, when it was impossible to prove that smoke emission was indeed dark, even though every instinct assured the EHO that it was so.

Responding to these various points, **Mr. L. Rutterford** of the DOE referred to the review of air pollution legislation upon which DOE is pledged to embark. He made it clear that other pressing matters were absorbing the attention of his Air/Noise Division. It was impossible for him to give any specific timescale for the completion of the review, although he anticipated that a consultation paper on the various issues could be produced in the spring of 1984.

Prevention rather than cure

Taking up the general point behind Mr. Barker's question on the Permitted Periods Regulations, **Mr. A.J. Fairclough**, Commission of the European Communities, referred to the Third EEC Environment Action Programme and the clear proclamation contained therein that in future prevention rather than cure should be the rule. The protection of the environment should no longer be regarded as a luxury to be pursued when money was available but dropped when economic constraints made it difficult; it was now recognised to be essential to society's well-being and development.

Moving discussion on to control of pollution from larger industrial plants, **Councillor Rooney** of Newtownabbey BC extolled the virtues of fuel additives, which he thought would play a major part in pollution control in the future. He believed that there was considerable scope for improving efficiency in energy utilisation and that more money should be put into such research.

Dr. Reed agreed that black smoke was a sign of obvious waste of energy; however, as far as he could see the only chimneys which regularly emitted black smoke in London were those serving the incinerators of hospitals. As far as industries under the control of the Industrial Air Pollution Inspectorate were concerned, the Inspectorate would never relax the standards enforced on all new plant. For existing works, there was a grey area in respect of how far it was possible to press for improvements when there were other demands for the resources available.

Hand over controls to LAs

Mr. Carson of Newport Borough Council felt that the success of local authorities in controlling smoke and SO_2 emissions by the Clean Air Acts was in stark contrast to the failure to control those same emissions from major installations, and wondered whether, on the strength of their past success, local authorities should take on board greater powers to control emissions from major industrial installations and thus help to solve the acid rain problem.

Roy Martindale (CBI) felt that it was unfair to compare the success in smoke control with the failure to control the emissions which contribute to acid rain. The timescales were all-important. It had taken many years for people to recognise the problem of smoke, come to terms with it, and put the necessary remedies into effect. In contrast, with acid rain, the problems had been studied intensively for only the last ten years or so. The point had not yet been reached where the way forward, to resolve the problem, could be clearly identified. He felt that the difference between central and local control of emissions was irrelevant; and indeed, that where longer range international problems were concerned, there was much to be said for dealing with the problem on a national rather than a local basis. **Mr. Rutterford** agreed, saying that it was only possible to criticise the control strategy (the dispersal of sulphur dioxide) with the benefit of hindsight. **Dr. Reed** felt that the discovery of North Sea Gas had been an invaluable aid in securing lower ground level concentrations of smoke and SO_2. He felt that air pollution control split between central and local government was a sensible arrangement which had been endorsed by the Royal Commission on Environmental Pollution.

Mr. Fairclough referred to the evolution of Community policy on the subject of acid rain and to the latest proposals for emission limits for large combustion installations. Acid deposition was seen as an urgent problem and one in which action was urgently needed. **Mr. Snow** considered that the resolution of the problem would require the commitment of individual governments and organisations to ensure that the achievements which could be made, would be made — and within a reasonable timescale. He was sure that acid rain problems could be solved in much less than 20 years.

The latter part of the discussion set the scene for the afternoon session on acid rain, with papers given by Dr. Binns of the Forestry Commission on effects of forests and soils, by David Kinsman of the Freshwater Biological Association on effects on water courses and fish, and by Lionel Rutterford of the DOE on international aspects and UK policy.

In his presentation, **Dr. Binns** said that acid deposition was causing alarm in Central Europe over forest decline; he thought that while the alarm might be justified, the causes were not clear. The decline was probably due to several factors acting together and current thinking was that a combination of ozone and acid mist was responsible; however, proof had yet to be provided. The level at which pollutants damaged trees and other plants had not yet been established with any certainty. There was no clear evidence of damage to forests or to forest soils in Britain due to acid rain, although dry deposition in Northern England had restricted tree planting in the past.

Water acidification

Dr. Kinsman pointed out that acidification of many catchments had proceeded

slowly from post-glacial times, but that since the Industrial Revolution, higher pollution levels had resulted in a much increased rainfall acidity. In certain areas acidified streams and lakes are now rather more common. Such sensitive upland areas have been identified in central Wales, the Lake District, Galloway and other large areas of Scotland. He then explained the effect of increased acidity on freshwater communities, with the proviso that increased acidity alone might not always be the direct reason for major changes, eg in fish populations. Finally, he pointed out that since the response time of the aquatic environment to reductions in emissions is not known, it was impossible to predict the likely chemical and biological responses to halving SO_2 emissions, for example.

An international problem

Mr. Rutterford's paper was an appreciation of the international dimensions of the "acid rain" problem and of the present UK position. The major question that arose was whether controls should be introduced to achieve further reductions in sulphur or other (notably nitrogen oxides) emissions which are involved both directly and indirectly. He set out the Government position, that scientific understanding of the problem in all its aspects was as yet insufficient to provide a clear basis for commitment to a very costly programme of emissions reduction, and that the most responsible action at present was to press forward with research under the aegis of the UN ECE Convention.

During the discussion, a degree of caution about the mechanisms and effects of acid rain was displayed by most speakers. **Dr. R.A. Barnes** pointed out that most of the controversial forestry damage had occurred almost exclusively in the Federal Republic of Germany. Damage in other parts of Europe, notably in Eastern Europe, was due to the phototoxity of sulphur dioxide. Having attended many conferences on the subject, he concluded that nitrogen oxides and nitrates were not on their own generally significant in terms of ecological damage. Only where NO_2 and SO_2 were present in fairly high concentrations and acted synergistically on growing plants was significant damage observed. As for the effects on UK freshwater ecosystems, he wondered whether they were a truly new phenomenon.

Dr. Kinsman said that it was very difficult to answer that point since few good scientific observations had been made until quite recently on eg the chemistry of upland streams and there was rarely proper evidence that fish had formerly been present in waters now lacking fish. However, in just a few instances it was known that there had been changes; for example, in some Welsh streams there had definitely been reductions in fish according to work done by the Welsh Water Authority.

Alarm bells sounded on FGD

Nevil Parkinson, CEHO of Selby District Council, rang the alarm bells rather more loudly, saying that while DOE and the CEGB were not yet satisfied that UK power station emissions were contributing significantly to the problem of acid rain, they were the largest source of both SO_2 and NOx emissions. On completion of Drax, the Ayr Valley Power Stations of West and North Yorkshire would burn 20 million tonnes of coal per annum over the next 30 years, emitting 600,000 tonnes of SO_2 annually into the atmosphere. Were desulphurisation of flue gases to become a required element of control, it could have significant impact on the local environment in the Selby area, with an

additional 1.8 million tonnes of waste to be disposed of annually.

Dr. Reed pointed out that there had been very little change in the emission of sulphur and nitrogen compounds for the last decade or so, and no changes in the precursors for ozone formation. All the pollutants had been present for the last ten years or more. However, in the last three years the Federal Republic of Germany had become aware of, and passionate about, the damage to German forests. They were urging on all countries a policy similar to their own, which involved the imposition of much stricter controls on industry. He wondered whether that damage really had become suddenly evident in the course of one year or so.

Dr. Binns said that the onset of damage (in the form of reduced height increment) had been traced back to about 1977/78. Growth of trees varied from year to year but if a tree grew poorly for two or three years then a forester would begin to feel concerned. If the needles started to go yellow and drop off the forester would get extremely concerned; that last stage had been reached only two years previously. There were many possible causes, eg sudden, severe frost, high ozone levels, drought and pollutant emissions. It was impossible to tell whether the problem would right itself on its own, or whether the situation would improve if nitrogen and sulphur dioxide emissions were to be reduced.

Doubts about catalytic controls

Dr. Duncan Laxen of the GLC's Scientific Branch, pointed out that ozone was also of some importance in Britain, with the occurrence each summer of ozone episodes during which the 80 ppb standard (set to protect sensitive crops and plants) was exceeded. He wondered whether it might not be prudent to introduce further emission controls on road vehicles, which would have the additional benefit of reducing acid deposition due to nitric acid and would also reduce roadside NO_2 levels. Mr. Rutterford said that further controls would involve, most probably, the introduction of a 3-way catalytic convertor, which in turn would involve additional costs to the motorist and additional energy costs. He also said that there were serious doubts about the effectiveness of convertors, particularly under European driving conditions, and the UK would require a great deal more information about the benefits to be derived from that method of control before embarking upon it.

Process odours

Wednesday morning began with an excellent paper on "Developments in Odour Control" by **Dr. R.L. Moss** of Warren Spring Laboratory. The paper drew on the extensive research undertaken by WSL into the control of process odours and was written in the light of much practical experience. Dr. Moss reviewed the sources of odour and complaints, the composition of process odours, the properties of odour and its effects, sensory measurements and general control methods. He considered that future research and development would concentrate on economically sound abatement methods, eg those with lowest energy costs. Of the various possibilities, adsorption and absorption were likely to be favoured. Biological treatment (biofilters) would probably be increasingly used for some odour problems as confidence in its efficiency grew.

Various odour problems occurring in different parts of the UK were highlighted during the discussion. The causes ranged from the emission of burnt rubber, to the fumes arising from the spray drying of food additives, to the problem of odours from transport (road and air). Dr. Moss said that it was most important to work back from the standard that had to be achieved to abate the nuisance, to the means for achieving the required degree of odour control. Another vital point was to precede whole plant installation of odour abatement equipment by a series of pilot scale tests, preferably supported by odour measurements.

Because of a last minute programme change, the rest of Wednesday morning was devoted to discussion of the very topical issue of straw and stubble burning. **Mr. Keith Turner** of the Countryside Commission had kindly agreed, at very short notice, to attend the Conference and give the Commission's views on the straw and stubble burning question. NSCA Secretary General **Air Cdre. John Langston** opened the session by giving the Society view. He also reported on the evidence compiled by the Information Department as a result of letters sent to the Society by individuals, firms, Local Authorities and health workers. This has been published under the title "Report on the 1983 Harvest Burn" and widely circulated.

Ban the burn

Air Cdre. Langston explained that the Society's policy had really remained unchanged over the past three years. The Society recognised that the only way to prevent the pollution was to ban the practice, and had therefore called for that measure within a short period of time. As for interim measures, the Society had proposed measures which it believed would substantially strengthen the control which local authorities could impose on individual farms in their areas. The Society was aware of a number of criticisms of its suggestions, the major one being that they might impose further strains on the already over-stretched resources of local authorities. The Society's reply was that the measures it proposed in effect simplified the law in the sense that proof would be easy to obtain. This would facilitate prosecution and add greatly to the deterrent effect of the law. The Society did not claim that its proposals were perfect, nor did it feel that they would solve the problem. However, they provided a practicable interim solution on a national basis, until a ban could be imposed.

Keith Turner, who is Land Management Adviser to the Countryside Commission, set out very clearly the background to the Countryside Commission's decision in the autumn of 1983 to withdraw support for the NFU Code, and to call for a ban on straw burning. Mr. Turner examined the agricultural case for burning, which he admitted was strong, and then looked at the problems for wildlife and the countryside which arose from the harvest burn.

The Countryside Commission were obviously most concerned with problems in the landscape since one of their main areas of responsibility is the promotion of a landscape of interest and diversity. From having played a major part in the slow evolution of a unique and beautiful landscape, farming is now perceived, all too frequently, to be a major threat to the landscape. In the Commission's view, straw burning has become one aspect of that threat.

Mr. Turner said that the Commission believed very strongly that disfiguring

damage should not have occurred had the NFU Code been properly followed. On its record, the Code was clearly ineffective and had been so in all the particularly bad years, characterised by generally fine and dry Augusts. The Commission had always made it clear to the National Farmers' Union that it reserved the right to change its mind about supporting the Code. In 1983, the Code had failed at the time when it was most needed and so the Countryside Commission, having carefully considered the matter, had decided to withdraw that support and recommend to Government that burning should be phased out over a period of three years. While the Commission recognised that all the problems associated with dealing with the bulk of surplus straw might not be overcome in three years, they hoped that acknowledgment by the Government of the need for an eventual ban would concentrate and expand research in all the necessary fields.

The National Farmers' Union had been invited to send representatives to the Conference, and **Mr. D. Collier** from the NFU Headquarters said that he could quarrel with little in either the NSCA or the Countryside Commission's view. However, he did not think it practicable to introduce an outright ban on straw and stubble burning, either immediately or within a short period of years. His main reason for this was the possible hazard which would arise from straw being set alight unplanned. He had some reservations about the proposals put forward by the Society for interim controls, although he agreed that there should be a limit on the area burnt, and that ash should be incorporated after burning.

Mr. Patrick Tory proclaimed himself both a farmer and a strawburner, but said that although he farmed right round an urban area he had received no complaints as a result of burning, over the past four years. His explanation for this was that he had taken care to carry out scientific tests (with the help of a friend in an aeroplane) to establish exactly what happened once straw was set alight, and to discover the least polluting type of burn. That was the method he employed, and one which he had drawn to the attention of Lord Belstead's straw utilisation committee.

Turning to the question of alternative uses for straw, Mr. Tory pointed out that the main problem with incorporating straw into soil was the large amount of acetic acid it produced as it rotted. Ten weeks had to be allowed in order for the straw to rot, and as a result it would be too late for the farmer to be able to start sowing winter crops.

Controls not applied to farming

Mr. Carson of Newport BC said that the issue was far wider than any one particular type of pollution from agricultural activities. The real problem was that the legislation which applied to all other types of industry and which was fairly strictly enforced in order to prevent pollution, did not apply to the agricultural industry and was not enforced on farmers.

Mr. Larkinson of South Holland DC in Lincolnshire represented an authority that had suffered very severely from the effects of straw and stubble burning during 1983, particularly in September. He proposed that the Conference should send a resolution to the Prime Minister seeking the introduction of a ban on straw and stubble burning — immediately and not in 3 or 5 years' time. An alternative proposal for a resolution was put forward by the Society's Immediate Past Chairman, **Mr. W.B. Twyford**. He

suggested that the Conference should resolve to support NSCA policy as set out in the letter sent by the Secretary General on behalf of the Society's Council, and that a copy of the resolution be sent to each of the Local Authority Associations seeking their support. While he had considerable sympathy with Mr. Larkinson's views, Mr. Twyford felt that the farmers' immediate problem of straw disposal could not be ignored and that therefore burning could not be banned overnight. There had to be an interim period for the necessary research and he felt therefore that the Society's policy was the correct one.

Noise problems today

Wednesday's third session was devoted to noise problems, a recurring theme at NSCA Conferences. **Dr. W.A. Utley** of the Building Research Establishment, Watford, spoke about the insulation of buildings against external noise, discussing methods of increasing the quality of insulation and the associated need to provide ventilation adequate for comfort and safety. He concluded that while an attenuation of 35 dB (A) is readily attainable in traditionally constructed double windows, a higher degree of insulation will require detailed consideration of the whole building envelope. Preliminary findings from a study of the acceptability of the noise insulation package installed under the Noise Insulation Regulations indicate that it is generally unsatisfactory.

George Vulkan of the Greater London Council's Scientific Branch spoke about the control of transportation noise through planning. Transportation noise is a serious problem, causing great disturbance to millions of people. The level of complaints does not reflect its genuine impact since people cannot identify a particular culprit out of the mass of traffic which is disturbing them, and feel that complaining would be useless. Unfortunately most of our communities have grown up without sufficient thought being given to noise prevention and the intense urban development in many areas restricts the ability of planners to ameliorate problems. It is obviously preferable to plan to prevent excessive noise from the outset, by separating the noise producer from noise sensitive development and people, although Mr. Vulkan emphasised the importance of not solving the problem in one area by simply moving traffic, or airports, to another.

Peter Sutton, formerly an industrial environmental engineer and now a consultant with Acoustic Technology Ltd. of Southampton, gave a review of noise indices and future requirements. Noise indices have been developed or have come into use in connection with different sources and situations. Ideally, a particular index should be equally applicable to all noise sources, but at the same time it should be simple and easy to measure and record. Peter Sutton looked at the components of a noise index, at those indices currently in use, and at some problems and possibilities in their application. This very difficult subject was put across with admirable clarity, the author capturing the audience's interest with slides as well as his words.

During the discussion, **Cllr. Mrs. B.J. Solkhon** of Brighton BC highlighted the difficulties of providing noise insulation in buildings converted for multiple occupation. She said that Brighton had many large old buildings which were constantly being converted for multiple use and considerable problems could arise

from noise transmission through party walls and floors, particularly where there was a diversity of population in one building. **Dr. Utley** said that, technically, adequate insulation of floors (the main problem area) was possible. Whether or not the Building Regulations would stipulate such improvements in the future was a moot point.

Geoff Charnley of Southampton Borough Council felt that designs to meet an internal noise specification were often insensitive to people's real need for fresh air and openable windows. He also felt that a more practical approach to noise control was needed. Curfew systems were used for the control of noise from light aircraft in Germany, and perhaps similar controls might be suitably applied to the control of vehicle movements around warehouse premises, for example, rather than setting unrealistic noise limits. Mr. Charnley also highlighted one of the difficulties of using different indices for different types of noise — the mathematical juggling involved.

Mr. C.J. Howell, representing the NSCA's South West Division, referred to the noise standard adopted throughout Gloucestershire in relation to new residential development near roads. That standard, Dr. Utley calculated, would ensure a maximum external noise level of 74 or 75 dB(A), which he thought not unreasonable. Surveys have shown that people would prefer to be exposed to levels no higher than 68 dB(A) L_{10} but, with the pressure on land, exposure to slightly higher levels was in some cases inevitable. **Mr. Goss** of Ealing London Borough Council envied Mr. Howell his power to prevent the construction of buildings if the Gloucestershire standard was exceeded, although in Ealing it would more or less preclude development. He considered that country-wide standards provided useful guidelines which should nevertheless be interpreted sensitively in the local context.

Criticism of the Noise Insulation Regulations came from **Mr. M.J. Squires** of Exeter City Council who pointed out their limitations in relation to traffic management schemes. **Mr. Vulkan** agreed that it was a great weakness that insulation could only be provided where there was a physical alteration to a road, or in the case of new roads. The Department of Transport has been reviewing the question, but the Working Party has yet to report.

Bill Snow of Warrington BC agreed with Mr. Vulkan that planning was the most important tool in the prevention of noise problems, although he regretted that the advice of Environmental Health Officers on the noise implications of projects had sometimes been given insufficient consideration by their colleagues in planning departments. Mr. Snow also expressed concern about the future of the GLC's Scientific Branch, saying that its team provided an inestimable service not only to the residents in the Greater London area but (via the publication and discussion of their research findings) to the population as a whole.

Black Country metalworks

Should anyone have come to the 50th Conference believing that air pollution no longer existed, their eyes would have been opened by the stunning presentations of ironfoundries and scrapworks in the Black Country, given by **Trevor Townsend** (of Wolverhampton MBC) and **Charles Brookfield** (Sandwell MBC). Many of these small works have disappeared in the deepening recession, but those remaining

cause the enforcement officers many headaches (if not worse). Operators are, or claim to be, short of cash to update or introduce pollution control equipment, and some also skimp on maintenance and good housekeeping.

Charles Brookfield's presentation provided a fascinating insight into the scrap metal industry, which can cause long-standing misery to local residents because of smoke, fumes, dust, noise and land contamination. Both he and other contributors to the discussion highlighted the dangers that workers in these small industries faced because of the contents of the scrap (which might include asbestos on old boiler plant, or contaminants such as lead) and their poor practices. **Councillor Martin** of Oxford City Council who spent his working life in the reclamation industry said that the picture Mr. Brookfield painted of conditions in the West Midlands reflected disgracefully on the industry. He agreed with Mr. Brookfield that far greater attention needed to be paid to the health of workers in the industry. In the cast of itinerant scrap dealers, for example, he said there were many incidents of early deaths from a wide variety of cancers and he was sure that cable burning, hand-sorting of fragmentiser waste and hand-breaking of batteries were responsible. However, he considered the reclamation industry to be, on the whole, a remover rather than a creater of pollution in that it contributed to the disposal of millions of tonnes of unwanted household and general waste.

Streamlining nuisance legislation

Ossie Dodds of Bristol City Council rounded the session off with another winner, a presentation on offensive trades which concentrated on the difficulties arising through the existing system of control. It will be remembered that DOE proposed revisions to the law of statutory nuisances and offensive trades four years ago. The legal situation is still unchanged, and the problems confronting local authorities remain. Mr. Dodds' own solution for the future control of these difficult but necessary processes was to retain the concept of statutory nuisance and the duty of inspection imposed on local authorities, but to give local authorities powers to anticipate and deal with nuisances before they could occur.

Mr. Hanna of Belfast City Council supported Mr. Dodds' recommendations for changes in legislation but considered that more attention should be paid to planning in order to prevent problems from the outset. **Mr. Webb** of Cheltenham BC was also concerned about planning, since many offensive trades were on potentially valuable re-development sites, yet their presence sterilised the land around from any further development since no one would want to be bang next door to an odour producing works. He wondered whether grant might be made available to re-locate offensive trades in more suitable areas. He felt that the problems caused by offensive trades should be dealt with on a national basis. Mr. Dodds felt it was difficult to justify the payment of what might be substantial sums in order to re-locate a particular works, especially where the problem had been created through the planning process. In such circumstances he felt that the onus was on the planning process to pay the cost — but the problem was that the money would in any event come out of the public purse and there were so many other demands on that purse at present.

Local authorities handicapped

All three authors stressed the point that local authorities were handicapped by

having to prove nuisance before action could be taken against various processes under the Public Health Act, and all three supported changes in legislation which would give local authorities greater powers of prior approval. That might involve a system of codes of practice, similar to those published under the Health and Safety at Work Act, suggested **Mr. F.G. McQueen** of South Tyneside BC. Alternatively, some type of licensing system might be possible, perhaps (in the case of scrap merchants) under existing systems.

It was agreed by all who heard the three speakers that they had given outstandingly informative and very practical, as well as very exciting presentations, which highlighted the difficulty that still exists in many parts of the UK in dealing with small, sometimes outdated industries which at the present time are strapped for cash, reluctant to spend money on pollution control, and very antagonistic towards attempts to make them do so.

Policy for major hazards

Problems on quite a different scale were considered at the last session of conference which looked at major environmental hazards and the protection of the community, against a background of a number of recent incidents which have created considerable public concern. **Edward Ryder,** of the Health and Safety Executives Hazardous Installations Policy Branch, pointed out that an industrial major hazard is like the elephant — difficult to define exactly but easy to recognise. The need to prevent incidents such as Flixborough had resulted in some powerful controls, now being applied by HSE. The EC Directive on major hazards also requires specific attention to be paid to the environment, so that the control policy had to be very carefully based to reduce risks, for both people and the environment, to acceptable levels. Mr. Ryder looked at the lessons that have already been learnt as a result of major accidents and at proposed changes in arrangements.

LA response to incidents

Michael Gittins and **Bob Wright** of Leeds City Council looked in general terms at the ways in which local authorities should prepare to deal with environmental incidents which might affect the community; in particular, the way in which the environmental health department should respond. Although no single document could hope to define hard and fast rules to cope with every possible range of events that might occur, experience could, they felt, refine and improve on the system. This point was reinforced by discussion of a case study of a major fire which occurred in a warehouse storing a mixture of inflammable chemicals and herbicides. This incident occurred in Leeds in 1982 and had a devastating effect on local residents and the local environment. Even now, two years later, the area is scarred with dead trees, ruined lawns and continuing minor pollution of the local stream which bears mute testimony to the scale of the disaster. Both authors felt that a series of such case studies would produce a document which would make local experience available nationally and would be extremely valuable. The discussion centred on the UK Notification Regulations, highlighting particular incidents of greater or lesser seriousness, and the relationship between HSE and the local authority. **Ivor Barker** of Sheffield MBC was particularly critical of the attitude displayed by HSE headquarters in one particular case, which had involved his authority in a series of increasingly acrimonious exchanges over a period of some eight months and had ended with

a "dismissive" reply from HSE. Mr. Barker expressed the hope that Mr. Ryder and his colleagues would subscribe to the spirit of the proposals in so far as they related to liaison and consultation.

Mr. Gittins supported him, saying that both officers and elected members in Leeds believed that HSE perhaps took too narrow a view of its responsibilities in such incidents. At times, he said, it was more by fortune than anything else that loss of life did not occur, and he felt that inquiries should not take place only when loss of life actually did occur.

Polluter pays?

On the question of whether the polluter paid the true costs of cleaning up after major incidents, which had been raised by **Stephen Carden** of Barnsley MBC, Mike Gittins said that in the Woodkirk incident he and Bob Wright had discussed, the polluter had certainly not paid since Leeds City Council had picked up the tab to the tune of £1,000 in order to remove paraquat and diquat that had contaminated the public highway. The Council had submitted the account to the company which operated the warehouse where the fire had occurred, and been told that as the local authority had not acted at the request of the Company, it did not consider itself liable to bear the costs.

Although the discussion on hazardous wastes took place at the end of the conference, when it is notoriously difficult to maintain a full audience, the considerable interest in the papers generated a lively debate from the quite respectable number of delegates present and provided a very worthwhile conclusion to the proceedings.

The Conference Proceedings (Part I: Preprints of Papers; Part II: Reports of Discussions) are available from the National Society for Clean Air, price £8.45.

The Society's stand at the Conference exhibition

DR J.S. CARTER, CBE – an Appreciation

In your last issue you reported the death of Dr John Stanley Carter (83) formerly Chief Alkali Inspector, and a member of the Society. J S was a character. In private and in public he could enliven discussion with humour, jest and dry observation as befitted a true Yorkshireman. He was dedicated to the cause of clean air, but down to earth and impatient of exaggeration. He believed whole-heartedly in the philosophy of employing "the best practicable means" to minimise pollution, placed great store on the need for proper technical understanding of the industrial processes which were causing offence, and of the remedies which might be applied. He took seriously the complaints the Inspectorate received from the public, yet he was convinced that the fastest progress would be made, not by the liberal use of the big stick, but through technical mastery, persuasion, persistence and the cooperation of the industries concerned wherever possible.

After the Beaver Report and the Clean Air Act, 1956, it fell to him and the Inspectorate to tackle pollution from a much wider range of industrial processes, for instance in the iron and steel and non-ferrous industries, electricity works, lime works, and the brick and ceramic industries. The number of works registered under the Alkali & etc Act rose from 872 to 2160, and the Inspectorate was considerably strengthened to meet its new responsibilities. He took great trouble with the recruitment and training of the new inspectors, determined that the trebling of their ranks should lead to no dilution of standards. J S had a strong sense of history, as readers of his annual reports will recognise. It gave him especial satisfaction to be the Chief Inspector in 1963 when the Alkali Act and the Inspectorate had their centenary. His annual report that year did justice to the early years of the Alkali Inspectorate; and as usual he provided a most readable account of his stewardship.

Throughout his life he was sustained by an absorbing interest in nature and wild life, particularly birds. It was a happy conjunction which enabled him at weekends to visit the Thames Marshes to observe wild fowl while keeping a wary eye on the Thamesside chimneys which were his charge. In his latter working years and in retirement he suffered increasing and eventually crippling disability through arthritis in the neck and spine. He bore these afflictions and the sad loss of his wife with notable courage, retaining until his death the liveliest sense of humour and interest in people he had known.

P.J.H.

SMOKE CONTROL

CLEAN AIR ACT 1956
EXCHEQUER CONTRIBUTION TO SMOKE CONTROL ORDERS 1984/85

The Department of the Environment has written to all local authorities who submitted programmes for 1984/85 notifying them of their allocations. All programmes submitted have been approved in full and the schedule of figures for individual authorities is as follows:

Region and Local Authority	£ Amount
Northern	
Blyth Valley	116,000
Darlington	10,286
Gateshead	51,560
Langbaurgh	54,500
South Tyneside	9,421
Stockton-on-Tees	204,000
North Tyneside	19,680
North West	
Allerdale	40,062
Blackburn	25,490
Bolton	53,058
Chorley	16,860
Liverpool	147,000
Oldham	29,731
Manchester	3,441
Preston	19,682
Rochdale	85,706
Rossendale	25,000
St Helens	28,000
South Ribble	18,354
Wirral	78,900
Yorkshire and Humberside	
Barnsley	348,220
Doncaster	331,716
Harrogate	76,550
Kirklees	63,348
Rotherham	111,467
Selby	64,600
York	18,400
West Midlands	
Birmingham	60,000
Coventry	38,531
Dudley	28,904
Lichfield	20,090
Newcastle-under-Lyme	16,300
North Warwickshire	46,525
Nuneaton	13,214
Staffordshire Moorlands	100,000
Stoke-on-Trent	147,566
Walsall	23,200
Wolverhampton	75,000
Worcester	35,000
East Midlands	
Ashfield	40,088
Bolsover	52,800
Bassetlaw	13,828
Blaby	7,143
Broxtowe	20,130
Chesterfield	53,900
Derby	34,680
Erewash	15,243
Gedling	7,625
High Peak	19,135
Mansfield	74,520
Newark	13,466
Nottingham	56,512
South Kesteven	4,620
Eastern	
Peterborough	5,699

Region and Local Authority	£ Amount	Region and Local Authority	£ Amount
Greater London Area			
Barking & Dagenham	27,257	Oxford	6,217
Barnet	23,040	Portsmouth	9,721
South East		*South West*	
Broxbourne	9,171	Bath	6,142
Crawley	2,474	Bristol	68,112
Gravesham	1,640	Northavon	23,400
North Bedfordshire	8,646	Exeter	14,150

There has been another change to the criteria in paragraph 10 of circular 11/81. The average cost per dwelling figures for the higher cost regions in the Midlands and North have been revised upwards so that overall only the exceptionally expensive smoke control orders need be referred to DOE for specific approval in principle. The new figures are:—

Yorkshire and Humberside Region	£400
Northern Region	£375
North West and East Midlands Regions	£300
West Midlands Region	£275
Elsewhere	£200

LEAD IN HOUSE DUST

Imperial College, London, have been awarded a two-year extension to their contract from the Department of the Environment to study lead, cadmium and other metals in urban and rural dusts and soils. The cost of this investigation, which commenced in 1981, now totals £500,000. The work, which is being undertaken by Dr. Iain Thornton and his colleagues of the Applied Geochemistry Research Group, Department of Geology, is concerned with the amounts and sources of heavy metals in the normal home environment.

In the first two years of the study over 5,000 households were examined in fifty-three city boroughs, towns and villages spread over England, Wales and Scotland. This is believed to be the first national survey of this type undertaken anywhere in the world. Garden soils, floor dusts, street dusts and school playgrounds were sampled. The second phase of the work will focus mainly on lead inside the home. The sources of lead in house dust will be studied; these include old paint and emissions from petrol driven vehicles. Exposure routes to residents, particularly young children, will be investigated.

FUTURE EVENTS

Warren Spring Laboratory is to hold a three day course on Dust, 1 – 3 May 1984. The course is aimed at Plant and Process Managers, Graduate Engineers, Health and Safety Specialists and Environmental Officers. The course covers the topic from generation to control and finally collection of dust. The course has developed from a successful series of one day seminars on dust control held in different parts of the country. Lecturers from WSL will be joined by a consultant, HSE representatives and researchers from Harwell and Bradford University to give comprehensive coverage of the subject. The fee for the three day course is £230 (inclusive of VAT).

Further details from: Mr. R.W. Higman, Warren Spring Laboratory, PO Box 20, Gunnels Wood Road, Stevenage, Herts SG1 2BX. Tel: Stevenage (0438) 313388.

Corrections (Vol. 13, No. 4)

Several gremlins slipped past the Editor's eagle eye last issue (Vol. 13, No. 4). Most serious was the misprint of 120 *u*g/dl for 12 *u*g/21 on page 144 (R.S. Scorer's 'Note', para 5, line 2). Apologies to the author and to readers; anyone who has queried the point has been informed already of the correction. At the bottom of page 146, lack of space prevented us from finishing a sentence! Dr. Holdgate was, of course, one of three noted scientists who compiled and edited UNEP's major report, "The World Environment, 1972 – 1982."

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New Fuel Saving Product Passes Rigorous Tests

A recently-developed engine combustion efficiency product which has undergone a series of tests to international standards promises fuel savings of between nine and twenty per cent. Known as the Gefarator it is now available to the public at a recommended price of £34.50. Fitting takes one to two hours and a national network of installation specialists is being set up to carry out the work. No maintenance is required.

The product works on the principle of exhaust aspiration — introducing fresh air into the exhaust manifold to dilute the exhaust gases which are drawn back into the cylinder during the period of valve overlap. Exhaust aspiration is a subject which is under close scrutiny by many car and engine manufacturers.

The Gefarator also boosts torque and brake horsepower, whilst reducing polluting emissions. It even permits the engine to be run on a lower grade of fuel, adding to its cost saving benefits. Research and development work is in progress to establish that using the Gefarator as part of a conversion package will enable current engines to operate on low octane, lead-free petrol.

Gefarators are at present available for petrol, diesel and LPG engines up to 6 litres capacity and units for larger engines will be available shortly.
Reader Enquiry Service No. **843**

Refuse as Fuel — Warmer Campaign Launched

In 1984, Britain will dump at least 30,000,000 tonnes of rubbish in holes in the ground, rubbish which could be recycled as fuel to heat homes and factories, schools, swimming pools and hospitals. At the same time, precious oil and coal stocks would be conserved, dangerous and unsightly waste tips closed down, new jobs created and pollution greatly reduced.

The Warmer Campaign has been launched in Britain to act as a two-way information catalyst and focus urgent national attention on the value of refuse as a practical and renewable source of energy.

Using a computer data-base to centralise, for the first time, the immense amount of world-wide knowledge and expertise on the subject, the Campaign will identify and be directed at key people in government, industry, finance, trades unions, the health service, environmental and energy groups and public life.

The project is funded by The World Resource Foundation, which was established in Britain last year to sponsor The Warmer Campaign and other environmental schemes, and is currently awaiting charitable status. Its founder is Hans Rausing, a Swedish industrialist now farming in England who, among other things, was one of the 100 founders of the World Wildlife Fund.
Reader Enquiry Service No. **844**

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Noise and Society

With so much attention being given to politically sensitive air pollution issues (*see page 67 of this issue*), noise matters have taken rather a back seat in Britain recently. But no longer: the Society is convening a standing technical committee on noise problems which will meet for the first time in August. The South West Division held a highly successful seminar on noise in April (*see page 54*), and this month sees the publication of a long-awaited NSCA book on noise: *"Noise and Society"* by Hylton Dawson. Hylton, who is chairman of the Society's South West division and a member of the national council, is one of our foremost advisers on noise matters. While he applies his knowledge of acoustics and noise control professionally within industry, he has an instinctive sympathy for people affected by noise from whatever source. His experience with low frequency noise, (published in an NSCA Conference paper), struck a chord with many individuals up and down the country, some of whom have made available their own extensive files on the subject to the Society.

Noise is a form of pollution which causes considerable distress and annoyance to millions living in this country. At present these reactions are unfocused; we have yet to create the climate in which noise control can really progress. The Society recognises that it must represent public feeling on this issue and work towards securing a quieter environment in which the noise from a whole range of human activities can be reduced.

Report on the 1984 Workshop
by
Jane Dunmore

Regulating the Impact of Air Pollution

The NSCA's 1984 Workshop was held at beautiful Lincoln College, Oxford, on the 28 and 29 March.

The programme was designed to alert local authority members and officers and industrial specialists to the future basis for air pollution control, and provoke discussion of the financial and resource implications of proposed measures. The control of air pollution is subject to frequent small revisions, but major changes are in prospect as a result of international pressures and initiatives from the Commission of the European Communities. At home, the government has promised to review the whole field of industrial air pollution control, a process currently delayed by the urgent need to formulate an acceptable strategy on acid rain and respond to EEC proposals.

The Workshop covered the impact of legislative requirements and change on both industry and local authority, with presentations from J. McKay of British Petroleum Company Plc, Ivor Barker of Sheffield City Council, Fred McQueen of South Tyneside Borough Council and David Clark of Middlesbrough Borough Council. Mr Clark stepped in at very short notice to give an excellent paper on the basis for central and local control, filling a gap left by the enforced withdrawal of DOE representatives from the proceedings. Another worthy last minute contribution was made by Maurice Frankel, who talked about environmental secrecy. Nigel Haigh of the Institute of European Environmental Policy spoke on principles and standards, Dr David Ball of the GLC's Scientific Services Branch discussed fuel use and pollution budgeting, and Chris Wood of Manchester University examined future trends in the regulation of air pollution. Finally, Stan Wallin of Warren Spring Laboratory examined prospective controls and clean techniques for stationary emission sources, and Dr John Weaving discussed the future of controls on mobile sources.

As at last year's Workshop, resources (or the lack of them) dominated the discussion. **Ivor Barker** highlighted the dilemma for the local authority whose desire to pursue pollution control is increasingly hampered by financial constraints imposed by central government, particularly in the area of revenue expenditure which affects the availability of manpower for specific tasks such as monitoring. Pleas for more finance to meet the potentially high costs of measures suggested by the European Commission were made by many delegates.

Other speakers highlighted developments which might reduce the cost of regulating air pollution, even if stricter standards have to be applied. **Tony Verdin** of Analysis Automation pointed out that although his company strives constantly to develop new instrumentation, in real terms the costs of measuring equipment are coming down substantially. **David Clark** of Middlesbrough intervened in the debate on NO_2 monitoring, which on the face of it is an extremely costly exercise. He pointed out that Middlesbrough Borough Council

monitors very widely for NO_2 using diffusion tubes which give a general picture of average (weekly) NO_2 levels over a wide area, at low cost. This helps to pinpoint hot-spots where more sophisticated monitoring would be necessary.

Dr David Ball gave a timely account of the work done by the Greater London Council's Scientific Services Branch in developing emission inventories based on fuel use. This type of exercise allows local authorities to move from a reactive approach, to the point where it becomes possible to plan the future control of air pollution. The very first emission survey was carried out by the City of London, in a door to door survey of fuel use in 1970. That was instrumental in bringing about the Various Powers Act which imposed a 1% limit on the sulphur content of fuel oil used in the City. Since then, other London boroughs have expressed a wish to introduce a similar limit, but have been stymied in their efforts by a Department of the Environment reluctant to permit measures which might restrict use of valuable low sulphur fuels to one part of the UK.

Dr Ball concluded that the inventory and modelling approach was extremely valuable, but for its full potential to be realised nationally, local authorities would require additional powers to specify fuel to be used by plant in their area. An extension of prior approval powers for local authorities is expected to be one of the most important issues considered by the Department of the Environment in their review of air pollution legislation. Sadly, this review has made so little progress that it was not possible to discuss it in concrete terms at the Workshop, but we hope that the views expressed there will play a significant part in influencing the structure of DOE's consultation paper.

David Clark pointed out that while central government lays down the ground rules for pollution control, within the context of national and international legislation, many responsibilities are devolved to local authorities. He considered this to be essential, since national control policies require sensitive interpretation at local level to ensure that environmental protection is not secured too rigidly at the expense of jobs and community development. Now, however, the UK's cosy, insular legal system is being invaded by ideas from abroad which it will not be easy to live with. Those in the UK (particularly within DOE) are, he felt, failing to persuade our European partners of the value of the best practicable means approach and are in consequence being strongly counter-attacked with arguments in favour of a more rigid "emission standards" approach.

Conflicting control systems

Inevitably, much of the discussion in the Workshop centred on this conflict in approach between the UK's traditional BPM system of air pollution control, and the more rigid and codified system adopted in Germany. **John Clarke** (CEGB) who chaired the first discussion session, set the scene by pointing out that the UK is caught in a flood of changes, with its old established procedures coming under scrutiny as new problems emerge. As he saw it we have to hold fast to three principles: the need to maintain the human scale in the application of regulations; the need for equity in the application of controls, and the need for an integrity of approach, based on knowledge and commonsense. He considered there to be a place for the application of sound practices from the past as we endeavour to meet the needs of the future.

Nigel Haigh insisted that best practicable means should not be put on a pedestal. The UK has, he explained, already got many of the elements of emerging European legislation. We have emission standards (in the presumptive limits set by the Industrial Air Pollution Inspectorate, and in the Grit and Dust Regulations). We have process and product standards, and a measure of preventative control under Town and Country Planning legislation. Even the Bubble concept (a standard for total emission, which involves drawing an imaginary bubble around a plant, area or even a state, and putting an upper limit on the total amount of pollutant allowed to pass into the bubble) has been used administratively on two occasions in the UK: the reduction in the lead content of petrol, which was based on the need to maintain lead in air at the 1972 level, and the European agreement on CFCs. "The Bubble" has been adopted in The Netherlands as the basis of controlling SO_2 emissions, and this notion is reflected in the proposals emanating from the EEC for a 60% reduction in SO_2 emissions from large combustion plant by a specified date.

Britain has protested not only at the level of reduction proposed, but at the basis for the reduction – emissions levels as at 1980. **John Clarke** pointed out that while the UK can be fairly certain that its data for total emissions that year is reasonably accurate, there is no such assurance about figures for other countries. Our emissions totals are based on calculations from known fuel use figures, but most other countries have not kept such a complete record of the sulphur content of fuels, and fuel use patterns. Thus, their calculations of total emissions are, in his opinion, little better than guesses.

Despite this, **Nigel Haigh** held that the crude percentage reduction figure at present postulated within the EEC is actually more advantageous to the UK than a target reduction figure derived by more sophisticated means. Although nowhere in the UK legislation is there enshrined a consideration for the environmental effect of our emissions overseas, Mr. Haigh said that the need to protect the environment of other states will nonetheless have to be recognised as a principle of British air pollution control policy from now on.

Reluctantly, or eagerly, it seems that all sides in the UK now accept this. Changes in the regulation of air pollution are seen to be inevitable: whether those changes will be incremental or radical was the question which **Chris Wood** addressed in his presentation.

Chris Wood has spent the last year in America, which gave him a particularly appropriate perspective to the current debate about controls in the UK. For, as he said, if the Federal Republic of Germany is currently leading European thought, it is the United States of America that has led Germany forward. While German air pollution control is not exactly modelled on the American system, it is closer to it than control in any other European country. Thus, elements of the American system are evident in the background to the Commission's proposals. Chris Wood pointed out that much of the conflict of view between the American/German approach, and the steadfast defence of British practices, has been heard previously in the debate on the draft Environmental Impact Assessment directive. The irony is that while the EIA directive looks like going ahead without disastrous consequences for the UK, the Commission's air pollution control proposals could introduce far wider (and possibly undesirable) changes into the UK control system.

Chris Wood considered that *some* change was as desirable as it was inevitable, in view of the widespread dissatisfaction with the secrecy and partiality of air pollution control in the UK. There is, for example, very little objective measurement of the success of our control system, although it appears to be both cheap and effective. While the American system has the advantage of openness, of public access to decisions and public participation in appeals procedures, Chris Wood warned that the UK must avoid some of its pitfalls, particularly over-regulation. The US system works, but it works expensively and bureaucratically, causing (in many cases) unnecessary expenditure. He thought it essential, too, that UK industry should be able to adopt the method of control it regards as most appropriate for meeting broad emission reduction objectives.

That last point had been emphasised by **Mr J. McKay** in his presentation. Mr McKay said that the Commission should be made to realise the high cost involved in its proposals. He believed that the Commission should have defined its objectives more clearly within a well developed overall strategy, and should have considered all the impacts, including the social and economic ones. Improved dialogue and better consultation with those affected was highly desirable; he felt that industry would have to play its part better in future, ensuring that it reacted rapidly to the changing regulatory scene and was involved, and understood the implications, at each stage in the process. Finally, he said that the Commission also has a responsibility to monitor the improvement derived from the controls it initiates.

Ivor Barker contended that the framework within which local government acts and the legislative controls available to it, have become increasingly inappropriate. Over the last 50 years, air pollution control has been exercised essentially through four acts of Parliament, the latest of which is nearly 20 years old. A large degree of discretion is allowed local authorities: it is up to them how they perceive local problems, and how they respond to them within the framework of statutory obligations: many of which contain both a discretionary and a mandatory element. If a local authority places a low priority on pollution control both elements are honoured more in the breach than otherwise. Thus, he believed there to be, all too often, inequitable control within the UK, depending on the priority attached to pollution control as one of the many tasks facing a local authority. In order to secure equality, local authorities require a more uniform level of resources (which conflicts with current Government spending policies). The same inequality is apparent on a wider scale, with DOE staff being cut just at the time when they are most inundated with demands in the field of air pollution control — which makes it particularly difficult for Britain to deal with its European partners on equal terms.

Clash over smoke control

The problems of lack of resources and public expenditure policies were highlighted in the presentation by **Mr F.G. McQueen**. Smoke control is now, perhaps, an unfashionable topic. Nevertheless, DOE see it as the principal means of achieving the targets of a major piece of EC air pollution control legislation — the smoke and SO_2 air quality standards. Mr McQueen foresaw a serious clash arising between constraints on local authority finance, and the ability of local authorities granted derogations under the terms of the directive to meet its requirements by the

due date of 1993. He was doubtful whether mandatory smoke control in mining areas would be politically acceptable — and political acceptability is the key to smoke control's success. Compliance with a law that is resented in the local community will soon be minimal; and then the legislation itself loses its credibility. Enforcement difficulties such as the corner shop problem are in any event likely to increase. With a greater proportion of the population on a low income, any cheap source of fuel is likely to be exploited. One solution put forward by Mr. McQueen is that the present financial allowance given by the DHSS for heating etc. could perhaps be given in the form of tokens for smokeless fuel only.

While several delegates agreed with many of these points, the general tenor of Mr. McQueen's remarks was felt by some to be overly pessimistic. **Stephen Carden** of Barnsley MBC felt that it was up to environmental health officers to persuade councillors that clean air is a priority, even in times of financial stringency.

Environmental secrets

Both Ivor Barker and Chris Wood had referred to the need for greater openness about emissions data; this theme was taken up by **Maurice Frankel**, who considered the series of reports by the Royal Commission on Environmental Pollution to have had a major impact on attitudes towards disclosure of information. Whereas 10 or 15 years ago it was common to regard disclosure of information on environmental subjects as rather appalling, people now tend to favour the idea. On the other hand, protective practices continue in many areas — not only in the field of air pollution, but in water pollution control, in secrecy about the siting of major hazardous installations, about the constituents of chemical products used at work, and in relation to pesticides' toxicity data.

As far as data on air pollution is concerned, Mr. Frankel did not believe that it would be vastly expensive to make more data available to the public. For example, it would not cost much to publish more widely what is already collected. Seven out of the ten Water Authorities have been putting their collected data on public record since 1974, without any wild allegations being made by the public, or any misuse of the data. Yet, in spite of the COPA 1974 powers, local authorities are not taking advantage of their ability to make emissions data public. Indeed, a peculiar reversal has taken place: it is now possible to find out more from the Industrial Air Pollution Inspectors' District Reports about what is going on in individual factories than one can find out from most local authorities.

Although Maurice Frankel made it clear that he was advocating proper protection for genuine trade secrets, some members of the audience displayed a certain scepticism about industry's reactions to the policies he was putting forward. The feeling was that industrial co-operation with control authorities will fly out of the window if the (uneducated) general public has free and full access to information about who emits what into the air. Among delegates who highlighted potential areas of misunderstandings **Dr. R.A. Barnes** (Esso Research) said that the night-time condensation of water vapour from cement plants is sometimes mistaken by the non-expert members of the public for dense clouds of cement dust.

In case it should be thought that the continued regulation of air pollution will give industry nothing but problems, **Mr. S. Wallin** of Warren Spring Laboratory pointed out that there is a great opportunity for the instrument manufacturing sector to play an important part in determining the sensible application of controls.

However, he considered that care is required in negotiations about directives which would apply to power stations. For example, within the EEC the West Germans and Dutch have the relatively simple task, in some cases, of replacing old power stations with new, effectively controlled plant, whereas the UK will have the far more difficult, expensive and wasteful task of retrofitting existing plant. Mr. Wallin said that a combination system of control is preferable: e.g. front end (sulphur removal from coal or oil), middle (control in combustion) and back end (flue gas desulphurisation), with industry being permitted to choose the most appropriate means according to circumstances.

The performance of pollution control equipment on plant was the subject of some earnest debate during the discussions. As **Dr. Jeremy Colls** of Nottingham University pointed out, there is a vast difference between plant specification on commissioning, and its actual performance. Dr. Colls considered that British legislation fails to provide industry with an adequate incentive to operate and maintain pollution control equipment effectively. There is every incentive to install the equipment in the first place, since works will not be licensed to operate under the Alkali Act unless they meet the requirements set by the Industrial Air Pollution Inspectorate. Thereafter, however, there is no financial reward in striving for higher standards. He wondered whether some of the elements entering the American system — pollution credits, emissions trading, etc., might provide an appropriate incentive in this country.

Dr. John Weaving's presentation on prospective controls and clean technology for mobile sources set out the motor industry's objective of producing vehicles with controls to limit their emissions in line with air quality standards. He looked at the work done by the Committee of Common Market Motor Vehicle Constructors, explaining in detail the derivation of a mathematical model (based on Turin) to predict the situation which would obtain with vehicles tuned to ECE regulations 15-04.

He made a plea for European regulations to be put on a scientific footing, and emphasised the high cost of controls — for example, he said that should catalytic controls be required in the UK the cost could run to some £2 billion per annum. This figure includes the extra cost of new cars (about £400) and the loss of fuel economy (about 10%).

The breadth of coverage of papers presented at the Workshop, and their topicality, would alone have ensured a worthwhile event but the high level of debate during the discussions made it a resounding success. There was only one thing to regret, and that was the absence from the proceedings of any representative from the Department of the Environment. Nevertheless, DOE will be able to benefit from the papers and the reports of the discussions. These are available from the NSCA, price £8.45 inclusive of post and packing.

SYMBIOTIC TECHNOLOGY

Terms to aid planning profitable technologies with reduced environmental impact

A Discussion Article

by

Stephen J. Robinson, M.Sc.

Contrasting two of the winners of the 1983 Pollution Abatement Technology Awards[1] gives cause for thought. B.P.'s entry, the oil spill solidification process (work out the benefits yourself), is an excellent example of Environmental Protection Management. But what is Earthworm Technology, submitted by Rothamsted Experimental Station, an example of?

Oil spill solidification is a tactical development, reducing the environmental impact of activities the company is already carrying out – drilling for, processing and selling oil. But the earthworm technology? Arguably it's a strategic development, planned from the outset as a new commercial opportunity. And I contend that this type of development has no name.

It isn't an Alternative Technology. Alternative to what? An Intermediate Technology? Between what? Besides, this term implies some inherent lack of sophistication, yet worm culture appears as advanced as other forms of husbandry.

The terminology associated with the environmental discipline has evolved alongside the movement. As such it contains gaps – or worse can be downright misleading or offputting. Take the word "Conservation". What does it mean? In certain situations it alienates key decision makers. In others, say where it appears as energy conservation, those same decision makers could be interested.

A word that means different things to different factions has ended up central to the environmentalists' most significant approaches to industry and government to date. I suspect the inevitable consequence of this is epitomised by the number of key decision makers who, despite its relevance and importance to their work, have not even heard of, let alone seen, the *"Conservation and Development Programme for the UK"*.[2]

Conservation should be a by-product rather than the main objective of most development. Future worm farms would produce protein, for feedstuffs, and compost. The safe disposal of the farm wastes the worms feed on is a bonus from the conservation point of view.

Look at the race there's been to develop a leadless angler's weight. Reducing the broadcasting of lead and increasing the safety of swans are by-products of a commercial opportunity.

There should be a name for this category of product, process or service. I propose "Symbiotic Technology" or "ST" for short. Obviously "Technology" applies to any gainful human activity – and if you think about it, every human activity involves gain in one form or another (survival, profit, pleasure, etc.). "Symbiotic" comes from biology – the association of two dissimilar organisms, often to their mutual advantage.

A definition of ST would read something like: "Any technology with reduced, neutral or even positive environmental impact that gives more gain than a conventional

technology serving a similar purpose".

Certainly ST exists. It appears through normal commercial pressures. Examples of Symbiotic Technology or products with ST aspects include biological pest control, where friendly bugs are imported to prey on crop pests; Uni-cem building cladding sheets, where Cape Universal have replaced asbestos with an organic fibre; ICI's cleaner, low cost FM21 cell for producing caustic soda and chlorine; electrostatic crop spraying, reducing costs and polluting waste as chemicals "stick" to plants; even home carbonating kits like the soda stream, cheap to use and reducing the need for disposable bottles. They are commercial opportunities where conservation happens to be the by-product.

You can probably think of your own examples. To help you, ST subdivides into two main categories. "Natural ST" encompasses all cost effective activities which are inherently environmentally sympathetic. Usually these are new commercial opportunities, derived through strategic planning. Earthworm technology appears to be Natural ST as are other types of organic farming, the use of resistant strains, certain biotechnologies and ecologically tailored energy supply technology.

Secondly, gainful activities which are rendered environmentally sympathetic through an additional process are "Process ST". This group includes pollution abatement technology, energy conservation technology, industrial landscaping and certain forms of recycling. This concept can neatly encapsulate the Nuclear Power controversy — is it 100% Process ST?

So ST exists. And it can be shown as a comprehensive umbrella term. But what's the use of another fancy definition? Well, that depends on your point of view. For instance, some of the more sophisticated environmental groups might welcome or encourage ST developments as part of problem-solving packages in certain situations. It sounds like speculation but has in fact occurred: in the anti-whaling campaign, Friends of the Earth actively promoted a whole range of environmentally acceptable substitutes for whale products — in effect a battery of ST to displace the conventional technology. I think it is a tactic that industry can expect to see more of in future.

One observation from the few ST examples given is that there is a winner and a loser (or losers) in every case. The winner is the ST innovator, profiting from a new and successful commercial opportunity. The consumer is a winner — benefitting from a more cost effective source of supply. The losers are those left holding the conventional, now redundant technology.

Take the leadless fishing weights. The manufacturers have the whole anglers' weight market to aim for. Makers of conventional weights could be competed out of existence. What is worse, from their point of view, is that tactically they are now in a very insecure position. If attacked on legislative grounds they can hardly argue that there isn't an acceptable substitute for their product. The producers of leadless weights can either remain silent or accelerate the improvement in their prospects by adding their voice to the environmental lobby. Similar arguments can be applied to the Soda Stream/non-returnable bottles case. If the bottle manufacturers come under legislative threat they cannot maintain there isn't a substitute for at least part of their product range.

By definition, a technology isn't ST unless it gives more gain or, in commercial terms, more profit. What is emerging is that a company with ST is at a considerable advantage. A competitor with ST is a major threat. Consumers prefer ST, not primarily through

environmental sympathy, but because it is more cost-effective from their own point of view.

Logically, the ST concept could help more key industrial decision makers' strategic planning for cost effective development with reduced environmental impact. It should help them both to streamline existing operations and to define new commercial opportunities, so contributing to the survival or growth of the enterprise.

The logical view is also likely to be a vision of the distant and ideal future. Companies are not noted for their strategic abilities, particularly large well established ones. Look what happened to the railways – once prosperous and now suffering a prolonged decline through competition with road and air transport. Look at Hollywood trying to ignore, then compete with, then ultimately being swallowed by television.

The list is considerable. How many tram companies do you know? Or British motorcycle manufacturers? All these sectors included companies which were the giants of their time. Now they're either going or gone. Their problem was they became product orientated rather than market orientated[3]. The railways thought they were in the railway business. They were wrong. They were in the transport business. The moguls maintained they were in the move business. Wrong. They were in the entertainment business.

The grocery chains said they provided personal service. A correct observation, but it didn't prevent them being mauled by the supermarkets who saw themselves as being in the retailing business. The dry-cleaners may have defined their activities correctly – cleaning woollen garments. But they took a trouncing with the arrival of home washable man-made fibres.

ST planning may be of value to companies wanting to avoid these circumstances through improving competitiveness, identifying new opportunities and coping with the pressures of an increasingly environment-conscious world. But which companies, either established but progressive or new and innovative, is a moot point.

A product orientated pesticide manufacturer could be seen as being threatened by a whole variety of ST substitutes. Processes like electrostatic spraying or fluid sowing, where each seed goes into the ground in a gel and chemical envelope, reduce the need for agrochemicals. They are attractive to growers because of the lower costs involved. Practices like the use of resistant strains and biological pest control could also reduce the need for chemicals.

Arguably the most product orientated giants today are the oil companies. All the major uses for oil were developed outside the industry. As the need for oil lamps disappeared with the advent of electric light so the use of oil in space heaters increased. As this went into decline with the advent of solid fuel central heating the industry was saved by its biggest boon yet – the internal combustion engine.[3]

Their high visibility and potential for great environmental impact meant the oil companies were amongst the first to get their fingers burnt in the rising flames of the environmental movement. It's no coincidence, therefore, that the oil companies have some of the most sophisticated environmental control centres.

The question is whether much of the work of these centres is just environmental protection management. Certainly this is vital from the point of view of society but only useful to the company in the short term. Any oil company where there is little environmentally orientated input at strategic or board level could be under threat from ST.

Theoretically, hydrogen as a common fuel or the development of nuclear fusion would hit oil interests hard, unless they had used ST planning to decide whether to be associated with such opportunities.

In practice a whole range of ST products and processes are already nibbling away at the edges of conventional oil markets. Devices like portable windmills for nomads, giant windmills for tropical islands, solar power and biogas installations could all have an effect, say, on the demand for local diesel generated power. It could be contended that the potential to work and shop from home afforded by information technology could have an effect on petrol consumption. Even developments like the Soda Stream have an effect on fuel – not as much is needed for transport as only the concentrate is carried. The rest of the drink finds its way into the home down the water pipes.

A limited number of companies exploit their products' ecological superiority as a selling point. Others can be seen to be benefitting from what is in effect ST planning – 3M UK, for example, with their 'Pollution Prevention Pays'.

The ST concept is primarily designed to help a wider body of decision makers appreciate the advantages of the environmental discipline. Having said this, it is most likely that ST planning will appear in industry in the short term via the financial institutions.

A project with ST aspects may have greater success finding funds as the term implies that it has some inherent competitive advantage. ST thinking, however, can offer financiers an immediate benefit that doesn't presume familiarity with ther terminology.

Discerning whether a technology is ST involves adopting an integrated approach. All the inputs up the chain of supply and down the routes of sale from the company have to be examined for environmentally sensitive aspects. Environment linked risks to a project include location and supply problems, health, safety and pollution issues, the dissatisfaction of key groups, and stiffer legislation. These can be manifested in a variety of ways, from price hikes to arson. Probably the most unpleasant manifestation is going broke through your conventional product being displaced by a Symbiotic Technology.

From the point of view of the investor, all these risks represent threats to return on investment. The ST approach helps identify such risks, enabling the investor to ascertain whether they have been pre-empted by the project management and allowed for in the costings.

Multilateral aid agencies and the World Bank have already altered their lending policies in favour of the environmental factor.[4] In part, this policy has come about through considerable losses attributabie to the effects of environment linked risks. Deforestation, for example, has resulted in landslips destroying cash croplands and in silting that has in some cases cut the energy potential of hydro-electric power schemes by half.

In the developing world the close and delicate interrelationship of environment and development rapidly becomes only too apparent if activities are ill-conceived. The ST approach is, in part, designed to help the financier avoid environment linked risks, less easily discerned but just as hazardous, in the tangle of developed markets.

Business and government are often at pains to point out that they live in the real world of endless compromise, a fact appreciated by the more pragmatic environmentalists. The ST approach could also help the harrassed legislator/referee derive mutually satisfactory compromises. Knowing what is a Symbiotic Technology, or searching for a battery of ST

substitutes, could in some cases ease local or national government off the horns of any develop/conserve dilemma.

Consider a simple local example. If wildfowl are suffering from lead poisoning, it may be expedient to pass a bye-law permitting only the use of leadless fishing weights on certain waters. Anglers, swan conservationists and the leadless weight manufacturers could all be expected to be reasonably satisfied with such a compromise. The losers would be the lead shot suppliers. But then, they don't have ST, do they?

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NOISE IN THE 80s and 90s

Report on the NSCA's South West Division One Day Seminar

by
Hylton Dawson
Chairman of the Division

On Tuesday 10th April 1984 at Bristol Polytechnic, 80 delegates and exhibitors participated in a lively and informative one-day seminar on the problems of noise in the 80s and 90s.

The objective was to inform delegates on the forms of noise pollution likely to affect most people and to discuss with them what can and must be done to provide a reasonable quality of life in a cost-effective manner.

The Chairman of the Seminar was **Councillor Len Poole, BEM, J.P.** who is the current Chairman of the National Society.

Planning and Noise

George Vulkan of the Greater London Council presented the first paper in which he gave a wide ranging dissertation on current noise problems in society and the means by which they can and should be controlled by planning. He pointed out that over the last decade, there has been a ten-fold increase in noise complaints about the activities of neighbours, and an increase in problems associated with traffic noise.

George's slide presentation showed many examples of successful noise abatement by the sensible use of natural topography, man-made barriers and well-planned traffic management. Air traffic problems ranging from short take-off-and-land traffic into London's Dockland to the massive high performance airliners using major international airports, were discussed. The speaker left a clear impression that sensible planning and properly executed technical measures can, in a very cost-effective way, improve the quality of life.

Road Transport Noise

The paper on Road Transport Noise, given by **Martin Smith** from the Society of Motor Manufacturers and Traders, impressed and indeed surprised delegates by providing evidence on the amount of money and technical effort being expended by vehicle manufacturers in pursuit of quieter transport. It was shown that the technology is now available but there is a lack of political and financial will to get these results applied in practice. The vast majority of goods in the shops have been transported by road, but for whatever reason, owners of lorries and through them purchasers of the goods, appear unwilling to pay the necessary premium.

One reason is that in the absence of legislation, buying a quiet lorry to compete with cheaper noisier lorries simply puts the operator at a financial disadvantage. Also, if some silencing measures such as enclosures or noise shields have to be removed from vehicles for maintenance, most operators simply do not refit them. Unless either financial incentives or legal sanctions are applied against noisy operators, the situation is unlikely to improve.

Delegates were informed that in Holland the situation is much better in that the purchase of a lorry which is silenced by 3 dB gives a 3% reduction in purchase tax, while a 6 dB improvement reduces the tax by 7½%.

This presentation gave delegates much food for thought, and reinforced the Technical Committee's discussions and actions on heavy vehicle noise which were initiated by Headquarters after representations from Bath City Council.

Transportation Noise — An Elected Member's View

In his paper on Transportation Noise, **Councillor Dennis Lovelace** of Bath City Council gave a lively and amusing exposé of the real life problems encountered by the archetypal sufferer (himself) living beside a busy road. This talk was illustrated throughout with tape recordings of the cacophony which he endures, examples ranging from heavy lorries starting and stopping on a steep gradient — the rattle and clang of badly maintained vehicles — the infuriating noise of small motorcycles, to the clangour of emergency vehicles with their often unnecessary sirens.

Dennis, as ever, forcefully pointed out that the problems of noise in the urban community are far too important to leave to the experts and that no amount of

platitudes or technical jargon can be a substitute for acceptable noise levels at the sufferer's ear drum!

Entertainment Noise

Mike Gittins from Leeds City Council gave an expert presentation on the much neglected subject of entertainment noise and showed the surprising degree of risk to which people submit themselves in out-of-work activities, such as Do-It-Yourself, shooting and attendance at Discos.

However, a Department of Environment Code of Practice is imminent which, among other things, is expected to specify a maximum level of 100 dB(A) at the nearest point to the loudspeaker and require that patrons be provided with information on noise levels created within the premises.

As well as giving the delegates food for thought about their own and other people's activities, Mike's presentation showed the difficulty in applying rules to protect people from their own actions which may at that time be giving them pleasure.

It became evident that there is a need for the National Society for Clean Air to be involved in the extremely long process of preparing legislative or advisory documents.

Noise at Work

The problems of noise at work were discussed by **Pat Woodcock**, South West Area Director of the Health and Safety Executive, who explained to delegates that although the 'Code of Practice for reducing the exposure of employed persons to Noise' was now ten years old, compliance with it was less than satisfactory. As a result throughout the United Kingdom one million people were daily exposed to the risk of deafness. Again, it was shown that the techniques for measurement and control of noise are well understood. The speaker drew the attention of delegates to the excellent book "100 Practical Applications of Noise Reduction Methods" published by the Health and Safety Executive. A major problem results from the great number of small firms which appear to lack the resources, expertise or maybe the will to get things done. There are many ways in which the Factory Inspectorate can be helpful to these people and they are now conducting a campaign to ensure that hearing hazards can be reduced by compliance with both the letter and, more importantly, the spirit of the law.

A Sufferer's View

The final paper, A Sufferer's View, was given by **Geoffrey Holmes** who is both a retired Chief Environmental Health Officer and a well known campaigner against noise.

Geoffrey discussed community aspects of the aircraft noise problem in a lively and informed manner, and then widened the debate into a great number of other noise problems drawn from his long experience in environmental health. Delegates were

fascinated by the way in which this presentation encompassed legislative, technical, managerial and humanitarian aspects of noise and by the way in which it related to major points in all the papers heard during the day.

Before the Chairman formally closed the proceedings, the Chairman of the South West Division spoke briefly on the discussions and the successful manner in which they had informed delegates what they could and should be doing now to alleviate noise problems. This drew attention to an important role of the National Society for Clean Air in providing a focus for both technical and political activity which should improve the quality of life for millions of people.

Delegates were reminded that the success of the meeting had been made possible by the time, effort and expertise expended by the speakers and by the willing financial and technical support given by those Companies who had both mounted an interesting exhibition and provided financial sponsorship. The firms concerned were:

ICI Acoustics
Bilsom International Limited
CEL Instruments Limited
Quietflo Engineering Limited
Audio Installation and Maintenance Services Limited.

The South West Division willingly acknowledged a debt of gratitude to them, and to the support of the event given by other Divisions of the Society.

The delegates unanimously expressed approval of the thanks for the excellent lecture, exhibition and catering facilities afforded by the Bristol Polytechnic and for the fact that the Secretary-General of the Society, Air Commodore J. Langston, had made time in his busy schedule to attend and give his support throughout the entire proceedings.

DIVISIONAL NEWS

Northern Division

The Spring Meeting of the Northern Division, held on 16 March at Middlesbrough Town Hall, was attended by 41 members.

The Mayor of Middlesbrough, Councillor C. Atkin, opened the meeting by welcoming the delegates to Middlesbrough, a town which has a very proud reputation in the work of pollution control and he paid particular reference to the invaluable work performed by Mr. R. Lander, Chief Environmental Health Officer and his predecessor, Mr. F. Sugden O.B.E., together with Councillor L. Poole.

Cllr. Poole opened the meeting by making reference to the recent deaths of Councillor J. Hudson, Stockton Borough Council and Dr. E.T.J. Fuge, H.M. District Alkali

Inspector. The members stood for a few moments in respect.

The major topic for the meeting was a talk given by Mr. L. Mair, OBE, retired Director of Environmental Health, Newcastle Upon Tyne. His title for the talk was *"Fifty Years in Retrospect of the Northern Division".* Mr. Mair gave a full and interesting paper on events which had taken place throughout the period of the fifty years, commencing with the structuring of the Northumberland and Durham Advisory Regional Smoke Abatement Committee, to the present day with the work of the Northern Division. He recounted the situations which he and his colleagues were involved in immediately prior to the 1939 – 1945 war to reduce smoke in the atmosphere. Paradoxically in the early part of the war Mr. Mair had to instruct stokers on how to create dark smoke as a defence against enemy bombers.

In conclusion, he posed the questions, "Where do we go from here?" and, "How can the (almost) evangelical zeal be rekindled?" Mr. F. Sugden, OBE, proposed the vote of thanks to Mr. Mair, drawing on his vast and well-remembered experience of days spent working in different parts of Yorkshire. Mr. Sugden was proud to have played an instrumental part in bringing Middlesbrough to the forefront of industrial authorities, having reduced air pollution to one which compared favourably with any other township throughout England.

W.C.B. Robson
Hon. Secretary

East Midlands Division

A meeting of the East Midlands Division was held on Thursday, 5th April 1984 at the Van Dyke Hotel, Worksop Road, Clowne, by kind invitation of the Coalite Group. The meeting was very well supported – some 66 members being present.

The Chair was taken by Mr. J.E. Marsh, the Vice Chairman, in the unavoidable absence of Mr. H.M. Clayton, the Chairman of the Division. Opening the proceedings, Mr. Marsh introduced Cllr. J. Allsop, Chairman of the Bolsover District Council, who extended a Civic Welcome to the delegates.

The Chairman referred to the death in November 1983 of Mr. A. Lister Robinson MBE, a Freeman, former Alderman and former Mayor of the City of Peterborough. Mr. Robinson had been active in the East Midlands Division since 1951 and was Chairman in 1973/74. Members stood for a few moments in respect.

Following announcements by the Secretary about the future programme, the Chairman handed over to Mr. R. Pane, Marketing Director of the Coalite Group and a Member of the Council of the Society.

Mr. Pane said that the Coalite Retorts had been designed in the early 1900s by Thomas Parker, a chemical engineer and the plant had not been changed apart from

improvements to the metallurgy. The Company had the distinction of being the first winners of the Gold Medal of the Smoke Abatement Society.

Following Mr. Pane's introduction, two presentations of the Coalite Group's activities were shown to the members. The first dealt with the many facets of commerce in which the Coalite Group is involved, and the second with the smokeless solid fuel for which they are so well-known. The interest in the presentations was indicated by the need to curtail questions and discussion because of time constraints.

At the end of the morning session, members were entertained to an excellent lunch by kind invitation of the Coalite Group and at the conclusion of the meal, Mr. Marsh expressed the thanks of the Division for all the arrangements made on our behalf and in particular, the excellent hospitality afforded us.

Members then moved on to the Coalite Works where they were conducted round in several small groups and were able to see the manufacturing process described in the morning presentation. Our thanks are due to all the staff who assisted with the presentations or acted as guides — Mr. G. Nichols, Mr. P. Plaistow, Mr. P. Lynd-Evans, Mr. M. Bagshaw, Mr. K. Mortimer, Mr. P. Green and Mr. G. Rothwell. Particular thanks are due to Mr. Pane who made all the arrangements at relatively short notice and not only made us very welcome but suggested that we should visit Coalite again in the future.

E.F. Raven
Hon. Secretary

LETTER TO THE EDITOR

Dear Editor,

It was with great disappointment that I read the contribution from your correspondent R.S. Scorer (Volume 13:4 pages 144-146). I have been closely involved in the lead in petrol debate for some years and have always maintained that opinions in this area are worthless unless supported by valid scientific research. In my capacity as Deputy Chairman of CLEAR, The Campaign for Lead-free Air, I have never sent a communication to any scientific journal without referencing the article or letter in question. Unsupported assertions have little influence on the scientific process, and one cannot hope to achieve a new consensus without reference to the existing literature.

No such considerations seem to apply in the case of Scorer's letter. He has made a series of unconnected and unsubstantiated observations which, had they emanated from an environmental pressure group, would have been dismissed as emotional propaganda. Thus, in the middle of a discussion of lead and I.Q., Scorer refers briefly to the New York study (which he does not reference) before going on to contrast blood lead levels in London children with other countries (for which he also provides no documentation).

In fact, the New York study (reference 1) involved blood lead analyses in 176,000 children and showed that blood lead levels fluctuated seasonally in parallel with the consumption of leaded petrol in the New York area. Scorer, like the Lawther Committee four years previously (reference 2) argued that this is not because petrol lead influences blood lead, but because children play out more in the streets during the summer months. Whilst this observation may be true it does nothing to diminish the importance of petrol lead, since dust is one of the major routes by which lead in petrol gains access to the human system (reference 3). Nor does he mention that Billick's New York findings have now been replicated in two other cities (reference 4), Chicago and Louisville, and that the NHANES II survey, which included both adults and children, showed a similarly high correlation between petrol lead and blood lead (reference 5). Indeed, this particular study, where data was collected over the four year period following the introduction of lead-free fuel to America, showed a correlation coefficient of 0.95 for blood lead and petrol lead but not for any other source of lead. Finally, the umbilical cord blood survey carried out in Massachusetts from 1979 to 1981 showed that petrol lead still accounted for 57% of the variance in blood lead, even after four years of the lead phase down programme (reference 6).

As in the New York study the Massachusetts study also showed that levels were higher in the summer than in the winter. Perhaps Scorer would argue that foetuses play out more in the streets during the hot weather!

Your correspondent then goes on to criticise the Isotopic Lead Experiment carried out from 1974 to 1981 in the Piedmont region of Northern Italy (reference 7). (Scorer refers to this as the Turin Study but again fails to give a reference, which suggests that he has read certain criticisms of the study but not the actual report.) It is not based on 35 subjects as Scorer would have us believe. 3,692 blood samples were taken from the Turin population and 2,188 from residents in the surrounding area. The figure of 35 refers only to the Turin residents who were sampled repeatedly throughout the course of the study. But this is a more than adequate sample for an isotopic study of this nature. The accuracy offered by the occurrence of naturally occurring lead isotopes and the ability to track precisely the transfer of lead from petrol to blood using the isotopic ratios of each sample is not dependent upon the number of subjects studied. Even if only three subjects had been studied the results would still be relevant for those three subjects. Certainly the Isotopic Lead Experiment missed an opportunity to study pre-school children, which is unfortunate as it is in this age group that one would have anticipated the biggest changes in isotopic ratio (the few samples which were taken indicated a contribution of over 40% from the petrol sold in the Piedmont region), but the results obtained in other sections of the population are not invalidated by Scorer's criticisms. Nor does he mention that a similar isotopic study in Belgium (reference 8) where all the petrol lead used is of a different isotopic composition to that occurring locally, showed that on average 50% of blood lead originates from petrol lead.

Another argument used by Scorer is that since some rural populations have blood lead levels higher than some urban populations, then lead in petrol cannot be a major problem. Again, however, his logic is wholly specious. One of the most important determinants of

blood lead is water softness, not because of the water lead content per se, but because water softness has a profound influence on blood lead independently of its effect on water lead. Thus, in a survey of houses with minimal water lead levels ($<10u$/litre) there was still a strong correlation between blood lead and water softness ($R = 0.56$, $P = <0.1$) (reference 9). Furthermore, hardening of water supplies results in a reduction in blood lead, even in houses where the initial water lead level was negligible (reference 10). The reasons for these phenomena probably relate to the antagonistic action of calcium and its effect on lead absorption. What it means in practice, however, is that even if petrol lead were contributing 100% of blood lead, there would still be large variations in absolute blood lead concentration between hard and soft water areas. Thus, it would not be difficult to find a rural population in a soft water area with blood lead levels higher than urban residents in a hard water area.

I have dealt with Scorer's criticisms in some detail, not because his arguments have any intrinsic merit, but because it is essential that their low quality should be widely appreciated. I would also suggest that Scorer's attempts to direct attention away from lead by suggesting that monies might be better spent on education and social reforms represents the worst type of hypocrisy. The truth is that societies which are unwilling or unable to mitigate the effects of lead on their most vulnerable members are unlikely to concern themselves unduly with substandard schooling or poor housing. Conversely it is no coincidence that Des Wilson, the Chairman of CLEAR, was formerly Director of the housing action programme Shelter, and has done more to promote social reforms in this country than any member of Scorer's scientific fraternity. Lead exposure remains a serious risk to normal child development and the contribution from your correspondent does nothing to relieve this unhappy situation.

Yours faithfully,
R. Russell Jones, MRCP
Deputy Chairman CLEAR

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PILOT'S LICENCE

Due to the long dry summer, the increased acreage devoted to cereals and the stupidity of some farmers, 1983 was the worst year for straw and stubble burning the country has yet seen. As the tally of incidents – from road accidents, to property damage, to pollution of towns and cities – steadily mounted, so the Society's often lonely voice of past years was backed by the swelling chorus of complaint from across the nation. By the end of the harvest the Society's consistently expressed view that the farming industry should be subject to the same clean air legislation that applies to all other industries had gained widespread acceptance – though not with the farmers, who rightly saw it as affecting their pockets – or with the Government, too willingly seduced by the farming lobby. But whatever else the holocaust triggered (and in this respect 1983 will surely come to be seen as the turning point) it produced a national consensus that the only way to cure the problem is to ban the practice. With hindsight it only seems strange that it took so many worthy citizens and organisations, from the National Society to the Countryside Commission onwards, so long to accept the obvious.

Although by no means all farmers choose to burn their surplus straw and their stubble, the Society accepted that it would be impracticable to ban the practice at once and, indeed, that for some farms there is no alternative immediately available. To this end the Society called for a legislative ban to take effect in five years which, bearing in mind the length of time it has taken for other smoke control measures to be implemented, appeared to be fair and reasonable. It was also accepted that in the interim period much could be done to control the worst excesses of the most selfish farmers through the enactment of primary legislation to permit burning in accordance with a code of practice. The Society proposed that the code should be based on the NFU original and list the precise conditions under which burning might take place. Readers who attended the 1983 Torquay Conference will remember the overwhelming approval with which this policy was received. Conference formally resolved that it should be brought to the attention of the Government, and that the local authority associations should be invited to give it their support.

Local Authority support for NSCA Policy on the Regulation of Straw and Stubble Burning

Association of Metropolitan Authorities
Convention of Scottish Authorities

Adur DC
Avon, County of
Barking and Dagenham LB
Beverley BC
Birmingham, City of
Blaby DC
Boston BC
Brighton BC
Cambridge, City of
Cardiff, City of
Cheltenham BC
Chesterfield BC
Cleethorpes BC
Coventry, City of
Dartford BC
Doncaster MBC
Dover DC
East Hertfordshire DC
East Kilbride BC
East Yorkshire BC
Edinburgh, City of
Fenland DC
Gosport BC
Gravesham BC
Greenwich LB
Hartlepool BC
High Peak BC
Hounslow LB
Huntingdon DC
Immingham TC
Kings Lynn & Norfolk DC
Langbaurgh BC
Leominster DC
Lincoln, City of
Manchester, City of
Middlesbrough BC
Mid Sussex DC
Newbury DC
North Bedfordshire BC
North Wiltshire DC
Norwich, City of
Nottingham, City of
Oxford, City of
Peterborough, City of
Portsmouth, City of
Purbeck DC
Rochester, City of
Rochford DC
Rotherham MBC
St. Albans, City & District
St. Edmundsbury BC
Scunthorpe BC
Selby DC
Sevenoaks DC
Sheffield MDC
Solihull MBC
South Cambridgeshire DC
Stockton-on-Tees BC
Teignbridge DC
Thamesdown BC
Thurrock BC
Torfaen BC
Waverley BC
Wellingborough BC
Woodspring DC

KEY

General Location of Authorities calling for:

- ● BAN within 5 years + Interim Primary Legislation
- ○ BAN within 5 years + other measures e.g. Strengthened Bye-laws
- ▲ BAN only
- △ Strengthened Bye-laws only

In the light of this, the National Council required that the Society's case should be sent to all Chief Environmental Health Officers with the request that they should bring it to the attention of their Committees. Council expressed the hope that this would result in a formal resolution of support which would in turn be brought to the attention of the local authority associations and others, such as Members of Parliament. Significantly, the Society was able to conclude this request with the statement that over thirty authorities had already endorsed the policy and taken action on the lines requested.

I am delighted to say that the response has been impressive. Altogether 88 councils, the Association of Metropolitan Authorities, and the Convention of Scottish Local Authorities have replied. Of these, eighteen authorities said that because straw burning was not a problem locally, they felt unable to express formal support for the policy -- although, in various forms of words, most expressed sympathy with it. Only six authorities said that they were opposed to any ban on the practice. The other 65, together with the AMA and the CSLA, called for a legislative ban on straw and stubble burning to take effect within five years. The vast majority of these authorities also supported the need for primary legislation. However, six felt this to be unnecessary, considering that strengthened Bye-laws would meet their purpose, while seven mentioned only their requirement for a legislative ban, presumably to take effect immediately.

Altogether, this represents a significant weight of opinion which the Government will be most unwise to ignore. It cannot but indicate strong support for Lord Alport's Bill which, now in Committee, provides both for a ban in five years and an interim system of licensing .... and because the Royal Commission on Environmental Pollution similarly calls for a ban to take effect in five years "without the need for statutory instruments or commencement orders" and to meet a "best environmental timetable", one would hope that the Government was at long last beginning to get the message. However, there are none so deaf as those who refuse to hear!

To all of this the Government would doubtless argue that far from ignoring the problem, they have acted speedily to effect its control. Since the turn of the year they have encouraged the National Farmers' Union (with the advice of interested national organisations), in conjunction with the Ministry of Agriculture, Fisheries and Food, the Home Office and DOE, to devise a substantially strengthened Model set of Bye-laws with a revised burning code to explain to the farmer how best to meet them. To be fair, the Model Bye-laws, where adopted, will impose a level of constraint that would have been wholly unacceptable to the farming industry prior to last year's harvest. And to the extent that the new Bye-laws are accepted and/or enforced, their requirements for wider firebreaks, restrictions on the area that can be burned at any one time, improved fire precautions and supervisory measures should do much to facilitate safe burning and minimise damage to property. To the extent that burning will no longer be permitted after dark and at weekends or on Bank Holidays, and that any ash or other combustion residues must be incorporated into the soil within 36 hours of the start of the burn, the smoke and smut problem will be reduced. But as we all know, these new restrictions will have little or no impact in reducing ambient levels of smoke experienced with

widespread burning during prolonged high pressure systems, or on Mondays, Tuesdays, Wednesdays, Thursdays and Fridays, or where the straw is damp, or where the burn is carried out in higher windspeeds (say, over 8 mph) when the char and smuts lift off the fields as the burn takes place. As you will see, and I am prepared to eat my hat in public if I am wrong, the new Model Bye-laws, where adopted, where obeyed or where enforced, will do little to reduce air pollution. What goes up, sooner or later, somewhere or other, must come down.

It need not be like this, and it really is extraordinary that apart from increasing the width of the firebreaks from 5, to 15 metres, the new Model Bye-laws take no account of the weather conditions which are, of course, the key factor.

In their written response to the comments they received on the draft Model Bye-laws, the Home Office, MAFF and DOE said:

> "Considerable disappointment was expressed because Bye-laws do not provide an offence for burning when wind conditions are unsuitable or during prolonged dry weather. The difficulty is that offences must be framed in terms whereby a person can reasonably ascertain his liability, and they must also take account of the problems of enforcement. Any offences related to windspeed and rainfall would create obvious difficulties both for farmers and enforcement authorities, not least because they would require quite expensive measuring equipment. The suggestion that burning should not be permitted on days when strong winds were forecast raises the objections that forecasts are frequently inaccurate and that windspeeds vary considerably within a meteorological region."

This is balderdash! Prolonged dry spells by definition are highly forecastable and, where a pressure gradient is established, any doubts about whether or not the wind is too strong to permit burning could be resolved to give the public the benefit of the doubt. To suggest that this is beyond the wit of the Met Office is simply silly. Legislation to permit burning in accordance with defined forecast conditions is entirely feasible. In 1971, after State-wide public hearings, the California Air Resources Board promulgated Agricultural Burning Guidelines which have since been incorporated in the California administrative code. The Board also adopted meteorological criteria for determining "permissive-burn days" — ie days during which meteorological conditions are likely to be such as to adequately disperse and transport the emissions from such burning. The criteria are delineated in the "Meteorological Criteria for Regulating Agricultural Burning." The Board is also empowered to regulate the areas which may be burned at one time. Additionally, field testing stations, perhaps several in each county, check the moisture content of the straw to give an indication of the amount of smoke/particulate matter likely to be generated.

The total acreage burned compares with that in this country. Permission is either granted or withheld following a decision by the Board's official at an early morning meeting with the meteorologists and a representative of the growers Association. The service is paid for by the latter (the polluter pays!) which also accepts that "burning is a privilege and not a right"!

This scheme has been operating in its present form since 1980 and is much more sophisticated than this brief description suggests. For example, the Counties further specify the extent and location of the areas where burning may take place simultaneously and are provided with continuous weather updates throughout the day to permit changes and optimise burning. Mr. Richard B. Booth, the Air Pollution Control Officer in the Department of Public Health, County of Shasta, writes that, "although it sounds very complicated, the system is actually very simple and works quite smoothly .... the programme is, of course, very costly, but its success has been well worth the costs involved .... after three successful seasons, our growers and the agricultural community are ecstatic over the programme. The public is also supportive of the programme due to its ability to help clean the air and reduce the amount of smoke complaints from the urban areas".

Finally, Mr. Booth suggests that we should visit California to see at first-hand how the programme works. I commend the idea to DOE and suggest that they should send a team including representatives of Warren Spring Laboratory and the Met. Office. Having lived in the Sacramento Valley for a number of years (and hunted duck on its rice paddies) I would be the first to agree that California is not the UK and that their system may not be exactly what we need over here. However, it demonstrates that the concept of granting permission to burn on the basis of a weather forecast is entirely feasible and I believe that we already have the basic infrastructure to enable a practicable system to be introduced without vast expense.

Well, whatever its shortcomings, the new Model Bye-law is now with us. The Home Office is to be congratulated for introducing it in time for authorities to adopt it before the harvest — and also providing for an increased maximum penalty of £2,000. As this article goes to press, I gather that so far about one third of a possible 300 authorities have sought permission to adopt them. While in one sense this is rather disappointing, it may also reflect the considered view of the majority that those particular Bye-laws are not worth the trouble.

In mid May the winter wheat on the South Downs is already six inches tall and the start of the harvest is only a few weeks away. The first letters on straw burning have already appeared in the papers and it is clear that the public is going to watch each and every move made by the farmers during the coming season. Responding to another letter to *The Times*, Mr. Simon Gourlay, Deputy President of the NFU concluded:

> "Our message to farmers is that if they do not get it right this time, they deserve all the fines meted out to them and they face the prospect of even stricter controls or complete prohibition. We accept that we are on trial and have only one more chance."

I believe he is right — in which case the quickest way to achieve the total ban so forcefully commended and earnestly to be desired is to have another glorious summer!

J.L.

NEWS AND REVIEWS

A NEW APPROACH TO AIR POLLUTION CONTROL

The past few months have seen a stream of initiatives on air pollution control emerging from the Commission of the European Communities. Five proposals aimed at combatting air pollution (primarily from sulphur and nitrogen oxides) have been put forward and are being earnestly considered in this country by select committees of the House of Commons and House of Lords, by the Government, industry and just about every relevant interest group in the country.

"Stop acid rain"

The overall objective is to secure tighter control of emissions thought to contribute to acid deposition in the European Community and in Europe. It is, above all, one Member State, the Federal Republic of Germany which has led the Commission forward, stirred by the intense public concern about damage to trees in the Black Forest. One in particular of the Commission's proposals bears the stamp of German drafting, and would steer the Community firmly in the direction of the "fixed emission limits" rather than the flexible, BPM-type approach to air pollution control: COM(83)704, on limiting emissions from large combustion plant.

The other proposals were: COM(83)173, a proposal for a council directive on combatting pollution from industrial plant; COM (83) 375, which is a proposal for a council regulation establishing a Community scheme to provide forests in the Community with increased protection against fire and acid rain; COM(83)498, a proposal for a council directive on air quality standards for nitrogen dioxide; and, COM(83)721, a communication from the commission to the council concerning environmental policy in the fields of combatting air pollution.

The first of these, the "framework" directive designed to combat air pollution from industrial plants, was adopted by the Council of Ministers on the 1st March 1984. In broad terms, the directive requires that there shall be provision for Community-wide emission limits based on the best available technology not involving excessive costs, and taking account of the nature and qualities of the emissions concerned. Such limits, which are to be agreed unanimously by the Council of Ministers, are to be proposed if Community action is considered to be necessary on the basis of scientific evidence.

Prior approval of emissions

Installations covered by the directive include many of those controlled in the UK by the Industrial Air Pollution Inspectorate: those concerned with energy, production and processing of metals, manufacture of non-metallic products, chemicals and waste disposal. There are also some works which are controlled by local authorities. In effect, the directive will introduce a system of prior approval of emissions from these various sources. This approach was broadly welcomed by the National Society for Clean Air in its evidence to both the House of Commons

and the House of Lords. The Government, too, held no serious objections to the proposals, providing that the BPM-type phrase: "best available technology not involving excessive costs" was included as a central part of the directive, and providing that any emission limits should be agreed by unanimous rather than majority decision. Having won on both these points, UK negotiators have yet to succeed in reworking the proposals in COM 704 to a form more acceptable to UK industry.

This 704 proposal is separate from the framework directive but is in a sense its daughter, since it would require that any new or substantially modified combustion plant should meet specified emission limits. It proposes further that total emissions of SO_2, NOX and particulates from large combustion plant (defined as any plant above 50 MW) should be reduced (by 60, 40 and 40% respectively) by 1995 using 1980 emission levels as the base. Member States would be required to draw up, not later than 31 December 1986, programmes for the progressive reduction of emissions to reach those targets.

Forest protection

COM(83)375, the scheme to provide forests in the Community with increased protection against fire and acid rain, was prepared by the Directorate General of Agriculture in the European Commission. Apart from its proposals on fire protection, the regulation provides for an elaborate Community-wide forest monitoring programme aimed at measuring the effects of acid deposition on the health and growth of trees and determining, where necessary, preventative or curative measures. An underlying theme is that acid rain alone is the cause of forestry damage — a hypothesis unsupported by positive scientific evidence, and doubted by scientists in several countries.

The last air quality standard?

The proposal for air quality standards for nitrogen dioxide, upon which the Society commented to both the House of Commons and the House of Lords, has been strongly criticised in many quarters, the principal objection being that the inbuilt safety factor was too great, particularly since the only study which showed a response amongst chronic asthmatics at 200 ug/m^3 NO_2 has never been replicated.

In view of the paucity of data on NO_2 levels in the UK the Society found it difficult to draw firm conclusions on the implications for this country of proposed directive. Further monitoring will obviously have to be undertaken and this could be an expensive exercise. The Society commended the use of diffusion tubes which have been successfully employed in Middlesbrough to obtain a general picture of weekly average levels of NO_2 and recommended that modelling based on emission inventories might also be helpful. The Society went on to state, in evidence to the House of Lords,
"In deciding what monitoring should be done, we consider that central government should liaise closely with local bodies. Unlike the monitoring strategy for smoke/SO_2 (air quality) directive, it will be important *not* to avoid hot spots."

The Commission's proposal for a future programme on the control of air pollution is an extremely wide ranging document which elicited a number of specific comments from the NSCA. On a more general note, the Society felt able to support the research and monitoring

efforts proposed by the Commission and indeed suggested that more comprehensive data should be obtained from many more sampling points in the UK to establish atmospheric pollution characteristics related to the acidity of rain and to the formation of photochemical oxidants.

Inadequate government resources

The Society was not convinced that the government is expending sufficient thought or resources on the control of air pollution. Referring to the earlier EC directive which established air quality limits for smoke and SO_2, the Society expressed disappointment with the operation of these standards in relation to existing clean air legislation and smoke control policy. The Society said: "The NSCA believes that there is a case for removing the descretionary element in smoke control, and for the Secretary of State to use the power conferred on him by the 1968 Clean Air Act to require local authorities to make smoke control orders."

The Society was even more disappointed with the lack of progress made in the review of air pollution control promised over two years ago by the Department of the Environment. This review is now urgently necessary in view of the adoption of the 173 "framework" directive. As William Waldegrave, Under Secretary of State at the Department of the Environment has pointed out publicly, we may need a new Clean Air Act to provide local authorities with the prior approval powers which they would be required to exercise under the terms of the directive. In the Society's view, the pressures on the very small team within DOE's air/noise division have become far too great and the Society regrets that government does not see fit to give the environment sufficient attention in terms of adequate professional staffing.

Government has not only fallen behind its own timetable for such important matters as the review of air pollution control, but is woefully slow in responding to ideas put forward by the Royal Commission on Environmental Pollution in their reports. The Society is unconvinced that the government has given sufficient thought, for example, to the operation of the best practicable environmental option, or actively promoted its adoption in the UK. And now, in their tenth report, the Royal Commission has proposed a further refinement with the "best environmental timetable". This is a concept which industry is likely to support since it gives recognition to the need for industry to be given good and sufficient warning of the intention to introduce measures which would necessitate changes in techniques and equipment for air pollution control.

Need to verify compliance

Apart from its misgivings about governmental shortcomings, the Society saw one other major pitfall ahead for the whole Community in grappling with the various directives. We have seen in the past that the UK often objects strongly to proposed directives while they are still at the negotiating stage. One of the reasons for this is that the UK wishes to be certain that it can comply with measures which it is required to adopt. Now, the UK is not perfect in that respect, but some other Member States of the Community are far less so and the current batch of EEC proposals for air pollution control imply a really substantial manpower and money commitment over and above that presently expended by the various Member States. Thus, it is essential that Member States can be assured of equal compliance throughout the community. Otherwise, far from a directive having the effect of ensuring that Member States have to meet equal

standards with roughly comparable expenditure, those countries which comply where others do not will be severely penalised. The Society believes it to be essential that enforcement agencies throughout the Community are equally well staffed and equipped and equally determined to pursue the directives' requirements.

Update

As this issue goes to press, Britain is coming under increasing international pressure to make an immediate commitment to a specific reduction in SO_2 emissions. The Prime Minister has been thoroughly briefed on the science and technology of the acid rain debate by representatives from industry and the civil service, but at present William Waldegrave is the Government Minister bearing the brunt of foreign criticism for our policies, or the lack of them. The British line is that to tackle SO_2 in isolation would be a mistake, since it is NO_x emissions that are increasing, and they play a dual role in the process of acidification and in the formation of ozone.

EUROPEAN COMMISSION PROPOSALS ON LEAD

At the beginning of May, the European Commission finally agreed the form of proposals on lead in petrol which they would put to the Council of Ministers for consideration at their meeting on 28 June. The proposals are that lead free petrol should be made available in Member States by 1989 and that new model cars should be designed to run on it from 1989, and all new cars from 1991. A descretionary element is allowed Member States, in that they can introduce lead free petrol by 1986 if they wish: which would allow the Federal Republic of Germany to proceed with part of its declared timetable on road vehicle emissions.

The Commission proposes to retain two grades of lead-free petrol: normal (92 RON) and super (96 RON). In addition, the Commission proposed that leaded petrol sold from 1989 should not exceed 0.15 grams per litre of lead. The proposals on lead free petrol were adopted by the Council of Ministers at their meeting on 28 June.

The Commission has further proposed a two stage reduction in gaseous emissions from motor vehicles. The first stage, which would involve a cut of about 40% in carbon monoxide, hydrocarbons and nitrogen oxides emissions, would be introduced for new models of car in 1989 and for all new cars in 1991. A second stage reduction in 1995 would bring the EEC broadly in line with requirements now effective in US and Japan.

LEAD IN PAINT

Following its survey of lead levels in new paints intended for domestic use — which found that 82% of paints sampled contained more than the level of 600 ppm recommended by the Royal Commission on Environmental Pollution — CLEAR is to promote a Private Members Bill to place the paint industry under statutory control. CLEAR says that the paint manufacturers have refused to take any constructive steps in the wake of RCEP's 9th Report. It calls the Paint Manufacturers Association's response "defensive" — a public relations exercise. The Paintmakers Association, which represents over 90 per cent of the

industry in the UK, recently worked with the Department of the Environment to produce a leaflet for distribution to the general public – *Lead in Paint*. The Association has also produced a short "filler" film for television in conjunction with the CBI.

The Bill, to be introduced in Parliament by Austin Mitchell, MP, would require that all paints sold for use on private residential accommodation, or for public institutions where people gather or reside, should contain less than 600 ppm lead in the dry film. The other provisions would specify labelling of the lead contents of paint cans, proper advice and warnings about the use of lead-containing paint, and the prohibition of sales to the general public of paint containing more than 5% lead.

EEC ENVIRONMENTAL POLICY AND BRITAIN

By Nigel Haigh, Published by Environmental Data Services Limited, 1984 at £12.95/US$20.

If, having read the account in this issue of the EEC's proposals on air pollution control and the Society's response you are eager to know more, you should turn to this book. Those who had the pleasure of hearing Nigel Haigh speak at the recent Workshop will anticipate the elegant dissection of Community and UK policies proferred in the first part of this book, the extended Essay. This explores the nature of the European Community's young environmental policy and the "germ of controversy and difference about it" viewed through British eyes. As Nigel Haigh points out, some of the elements of Community proposals which seem at first sight most strange to us in this country do not, when we come to examine them, really hold the shock of the new.

But there are other consequences of a strengthened Community environmental policy which are already introducing insidious changes. Nigel Haigh writes: "A point much commented upon is that the Community involves some loss of sovereignty for Member States – in practice loss of freedom for national parliaments and governments. What is less frequently noticed is that simultaneously it can also centralise in the government's hands some of the powers that had previously been devolved to local and other authorities."

The Second part of the publication, the Handbook, sets out the various items of Community legislation on the environment in such a way that their effect on Britain can be assessed. Six chapters deal with one of the subject matter areas into which the Community's environmental policy can conveniently be divided, e.g. air, chemicals, noise. These chapters in turn are divided in sections dealing with each item of Community legislation or groups of items, and preceded by a section outlining relevant British legislation (which is not intended to be complete but covers the same ground as does the Community legislation). This enables one to see at a glance which items of British legislation already implement EEC requirements.

The final part of the book analyses more specifically the impact of Community legislation on Britain, including the degree to which Britain has formally complied with various directives.

FUTURE EVENTS

An Update on Acid Rain

The Centre for Extension Studies, University of Technology, Loughborough, is organising a one day seminar on Acid

Rain to be held on the 22 November 1984 in the Conference Room at Baden Powell House, London. Speakers will include Dr Gwyneth Howells of CERL, Dr. W.O. Binns of the Forestry Commission, Mr. Stan Wallin of WSL, David Baldock of Earth Resources Research, and Tom Burke of the Green Alliance. Fee: £35.00 (inclusive of buffet lunch).
Details from: *Helen Dison, Centre for Extension Studies, University of Technology, Loughborough, Leics. LE11 3TU.*

STRAW BURNERS

During last summer's NSCA enquiry into the problems of straw and stubble burning, we had one or two letters from people who complained about a related problem, emissions from strawburning appliances used (particularly by farmers) for home heating. At first sight, this type of apparatus may appear to be a prudent solution to at least part of the problem of surplus straw. Farmers are, after all, unlikely to be living in smoke control areas. However, for some of their neighbours the cure is in fact very much worse than the disease: a heavy, pungent smoke that can cause misery for at least two thirds of the year instead of just a few weeks at harvest time. As one NSCA member wrote: "This smoke does not rise like other smoke but moves horizontally and penetrates houses in its path".

Mr. and Mrs. R.A. Waldron (of Crowbush Cottage, Chatham Green, Little Waltham, Chelmsford CM3 3LF.) would like to hear from anyone who has been affected by these appliances, to share experiences and discuss possible courses of action.

NEW GUIDANCE ON EXPOSURE LIMITS

A new Health and Safety Executive Guidance Note on occupational exposure limits has been published, giving advice on short and long term exposure limits in the workplace, listing both control limits and recommended limits. *Guidance Note EH 40* replaces EH 15/80 and will be reprinted annually with any necessary revisions. Changes to the list of exposure limits will also be published by HSE in the *Toxic Substances Bulletin.* This new publication represents a departure from the

former practice of reproducing TLVs under copyright from the American ACIGH list.

Some ten control limits have so far been adopted under UK legislation. These are usually based on a detailed assessment of toxicity and other data and should not normally be exceeded. The Health and Safety Executive will use these control limits in determining whether, in their opinion, the requirements of the relevant legislation are being observed. Failure to comply with control limits or, where practicable, to reduce exposure still further, may result in enforcement action.

The recommended exposure limits listed in Part II of the Guidance Note are considered to represent good practice and realistic criteria. The Inspectorates will use these as part of their criteria for assessing compliance with the HSW Act and other relevant statutory provisions. These are about 450 substances in this class.

All the exposure limits in the Guidance Note apply only to single substances. However, the majority of exposures of work people in industry occur in atmospheres containing two or more substances. Since this document does not offer practical guidance in formulating limits for these situations, the Chemical Industries Association (CIA) is currently preparing a suitable document.

SURVEY OF ENVIRONMENTAL ACHIEVEMENTS IN JAPANESE INDUSTRY

The Industrial Pollution Control Association of Japan has recently published a book surveying the environmental achievements of Japanese industry, entitled "Environmental Protection in the Industrial Sector in Japan".

The book is full of useful information about current standards and techniques for pollution control in a major industrial nation. The first part of the book is an introduction to Japan's environmental policies, and the second part details environmental protection measures taken by the major sectors of Japanese industry, looking not only at air pollution control measures and technology, but also at water pollution control and solid waste treatment in various industries. The third part of the book is a directory of pollution control equipment manufacturers and suppliers. Japan's environmental laws and regulations are set out in an appendix.

The book is obtainable, price US$20 (inclusive of postage) from: IPCAJ, Shuwa Toranomon No. 3 Bldg., 21-8 Toranomon 1 Chome, Minato-Ku, Tokyo 105, Japan. Bank remittances should be sent to a/c No. 3025 of the Mitsubishi Bank, Toranomon Branch, Tokyo.

25 YEARS OF CLEAN AIR AND NOISE CONTROL IN MANCHESTER

Readers may remember the excellent publication "Twenty Years of Air Pollution Control" published by the Manchester Area Council for Clean Air and Noise Control in 1979. The Council have now brought their review up to date in a completely new publication which reviews improvements in air quality and noise control achieved in the areas of the ten local authorities within the Greater Manchester Metropolitan County Authority, and the five adjoining district councils represented on the MACCANC. The Council, an advisory body, carries out

investigations, research, publicity and education into air pollution and noise control. It reflects a considerable body of expert opinion on many aspects related to these subjects and has, through its technical committee, considered and given guidance on many aspects of pollution and its control.

The theme of the 25 years review is one of successful co-operation between the public and local government which has achieved a transformation of the region from one of the most heavily polluted in the country to the far healthier environment its residents now enjoy.

The review, which is beautifully illustrated and which covers contaminated land, quarrying, opencast coalmining and future energy needs as well as air pollution and noise subjects is obtainable, price £2.40 (inclusive of postage) from: The Publicity Officer, Mr. A.G. Ward, Principal Environmental Health Officer, City of Salford, Environmental Health Department, Cromptom House, 100 Chorley Road, Swinton, M27 2BE. Cheques or postal orders should be made payable to: "The Manchester Area Council for Clean Air and Noise Control".

RECENT DEVELOPMENTS IN THE METHOD OF USING STICKY PADS FOR THE MEASUREMENT OF PARTICULATE NUISANCE

A.L. Beaman and R.W.S.M. Kingsbury
W.S. Atkins and Partners

Introduction

In 1981 the authors of this paper described a simple and inexpensive measuring system for the assessment of nuisance from deposited particulates. In essence, three quarters of a 15 cm square sticky white 'contact' or 'fablon' sheet is exposed for 1-5 days. On collection, the unexposed surface is revealed and the whole surface sealed. A simple reflectometer technique compares the exposed and unexposed portions (Reference 1).

Since then a number of improvements have been made. As there continues to be interest by the readers of *Clean Air*, evident from the enquiries received by the authors, this paper has been prepared to report on the advances made.

The reader is directed to the original report for details of the measuring system.

Improvements

Method of mounting. The previously reported method set out the sticky pads and baseboards horizontally on the ground. Difficulties were often experienced in areas of tall grass and on bare ground. In the former situation exceptional care was necessary to avoid disturbing grass seeds and pollen when leaving or returning to the sample. On bare ground low level dust saltation could lead to non-representative deposition rates.

To overcome these difficulties the pads are now mounted on 900 mm soft wood posts driven into the ground. Figure 1 illustrates the mounting post which also allows a pad to be mounted in a vertical plane facing upwind towards the suspected source. Using both vertical and horizontal sticky pads

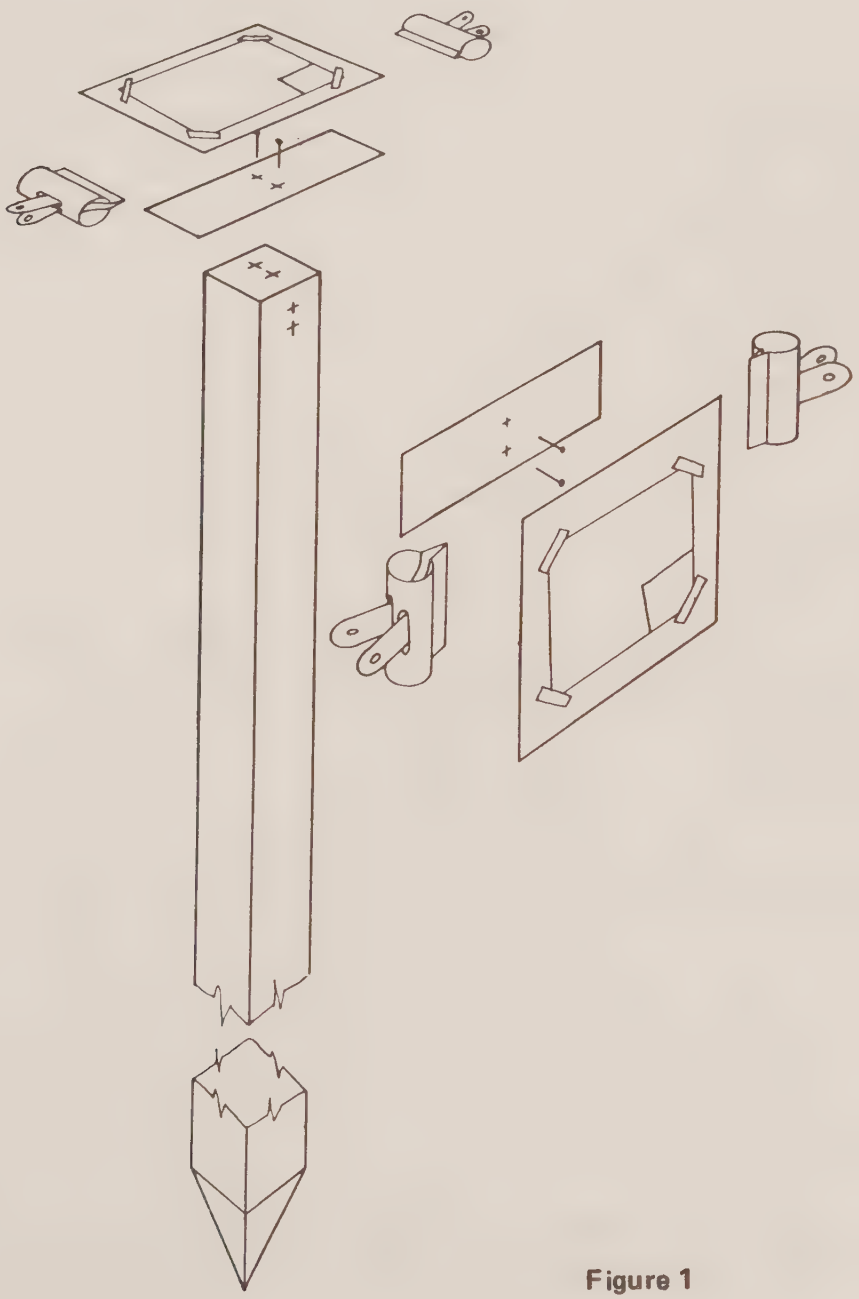

Figure 1

it has been found that the ratio R_{VH}* between the effective surface area coverage on vertical and horizontal pads falls with distance from the source for a particular wind speed. About 100 metres from a land reclamation site R_{VH} was measured as 10, about 1 km away R_{VH} was 1 and by 2 km R_{VH} had fallen to 0.4.

Work is continuing on this aspect to investigate the possibility of using this ratio together with particle size distribution and wind speed to determine the location of dust sources by extrapolation and interpretation.

Method of sealing exposed surface. The use of a clear lacquer spray has been adopted as a matter of routine.

Modifications to increase the sensitivity. Measuring the effective area coverage (EAC) of particulates on a sticky pad with a smoke stain reflectometer is acceptably accurate when the % EAC is between, say 5-20%. However, reduced exposure times or low deposition rates can lead to a very low EAC. Therefore, the sensitivity of the top 10% of the scale has been increased by installing a simple op-amp circuit between the reflectometer circuitry and the meter (see Fig. 2).

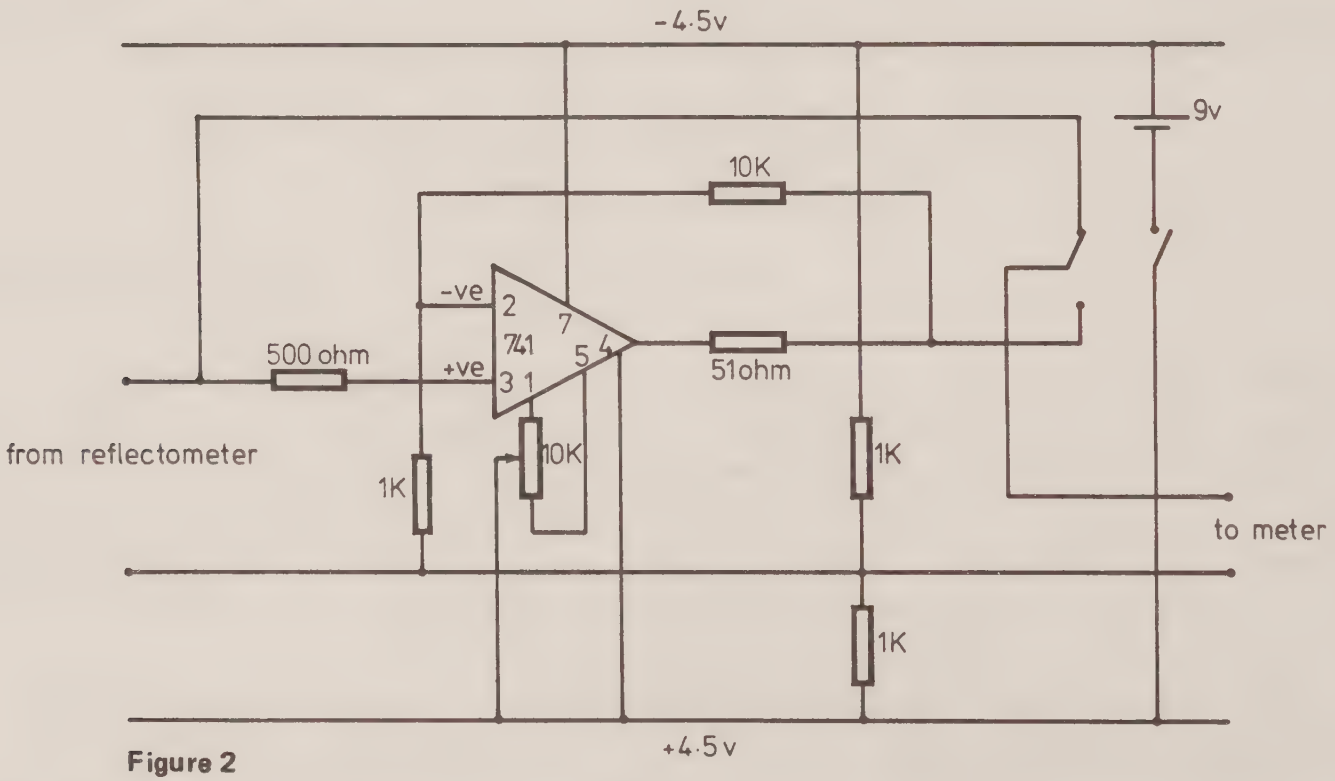

Figure 2

* **Footnote**

$$R_{VH} = \frac{\text{\% Effective area coverage in vertical plane}}{\text{\% Effective area coverage in horizontal plane}}$$

When the amplifier is switched on the sensitivity is increased tenfold. The amplifier runs off a small 9v battery fitted on the side panel of the instrument box. The double-pole double-throw switch allows the reflectometer to be used normally or amplified. It is mounted on the faceplate with the 10 turn amplifier sensitivity potentiometer beside it.

In use the reflectometer head is placed on the control surface (100% reflectance). With the amplifier switched off the needle is set to 10 using the normal sensitivity control. The amplifier is then switched on and the needle set to 100 using the amplifier sensitivity control. The whole scale 0-100 now shows the top 10%, i.e. 90-100%.

Relationship between effective area coverage and gravimetric deposition rate

Practical tests have determined the relationship between the effective area coverage and the gravimetric deposition rate. Minus 75 micron dust was dispersed in air using a fan and allowed to fall onto a weighed sticky pad of known area. This was reweighed to determine the gravimetric deposition rate. The corresponding percentage effective area covered (EAC) was then measured using the smoke stain reflectometer. Incremental amounts of dust were deposited onto the pad and for each both the gravimetric deposition rate and the effective area covered were determined. The relationship so obtained is shown in Figure 3.

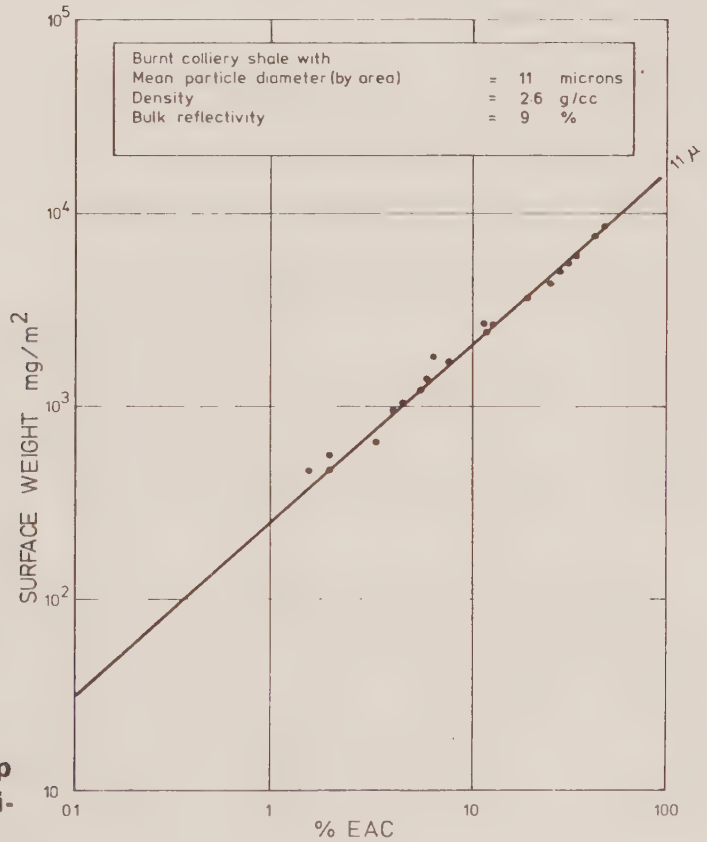

Figure 3 An example of the relationship between effective area covered and the gravimetric deposition rate.

It should be noted that Figure 3 relates only to the type of dust tested; burnt colliery shale of density 2.6 g/cc and gross reflectivity (i.e. 100% cover) of 9%.

Other dusts with different densities, reflectivities or particle size distribution would have a different EAC to mg/m^2 relationship.

An important finding from this and similar investigations indicates that the following relationship holds true:

$$\text{Mass deposition rate} = 667 \times \frac{\%EAC}{(W1\text{-}W3)} \; d \times p \quad mg/m^2 \qquad (A)$$

where %EAC = percentage effective area coverage
W1 = reflectometer reading from clean surface
W3 = reflectometer reading from 100% dust coverage
d = average particle size in microns by projected area*
p = density (g/cc)

* this is not to be confused with average particle diameter by number, surface area or by weight.

Relationship between effective area coverage and airborne particulate concentrations

A direct comparison has been obtained between the effective area coverage and the airborne particulate concentration by exposing sticky pads alongside high volume samplers at various distances from a very dusty source. The relationships found were as follows:

$$\log_{10} \frac{mg}{m^3} = 0.91 \times \log_{10} \frac{(\%EAC)}{(\text{ day})}_{\text{HORIZONTAL}} - 1.19$$

and

$$\log_{10} \frac{mg}{m^3} = 0.685 \times \log_{10} \frac{(\%EAC)}{(\text{ day})}_{\text{VERTICAL}} - 1.07$$

The deposition rate is equal to the product of the airborne concentration and the deposition velocity, i.e.

$$\frac{mg}{m^2/day} = \frac{mg}{m^3} \times (\text{deposition velocity } \frac{m}{s}) \times 24 \times 3600 \qquad (B)$$

Using this equation and equation A it is possible to derive the relationship between effective area coverage and airborne concentration, i.e.

$$\frac{mg}{m^3} = \frac{667 \times \%EACdp}{(W1 - W3)} \times \frac{1}{24 \times 3600 \times V}$$

$$\frac{mg}{m^3} = \frac{7.72 \times 10^{-3} \times \%EACdp}{(W1 - W3) \times v}$$

where v = deposition velocity (m/s) and which is a function of the particle size.

Thus by using the sticky pad technique to obtain a measure of the effective area coverage, a microscope and a density bottle, it is possible to obtain a reasonably accurate measure of the gravimetric deposition rate and the airborne concentration.

Table 1 has been included for those readers who are not able to measure particle size distribution (by projected area), density and gross dust reflectivity. This table provides typical data for use in calculating approximate gravimetric deposition rates using formula A. Average particle size by projected area is particularly critical (for environmental dusts projected area average particle size is frequently 3 - 4 times larger than average size by number).

Table 1

Typical reflectivities and densities

Dust	*Reflectivity %*	*Density*
Coal	5	1.5
Coal shale/peaty soil	10	2.6
Common soil/general dust	20	2.2
Sand	30	2.6
Cement	30	2-3
Brick	40	2.5
Limestone	40-60	2.7
China clay	80	2.6
Chalky subsoil	70	2.7
Magnesium carbonate (BSI standard white)	100	3.0
Calcium carbonate	110	2.7

To estimate particle size of a dark dust on a white surface

Visual appearance of pad at arm's length	*Approximate Average diameter by projected area μ*
Generally uniform grey sheen with some discernible particles	1
Mainly just discernible particles with some larger particles easily visible	10
Mainly coarse particles, majority visible	50

Comparison between deposited particulate criteria

In reference 1 it was suggested that typical levels of deposited dust and public response to it in terms of effective area coverage were as given in Table 2.

Table 2

% EAC/day	*Typical Situation*	*Public Response*
0.01	Rural	
0.02	Suburban/small towns	
0.2		Noticeable
0.3-0.4	Urban	
0.5	Rural summer time	Possible complaint
0.7		Objectionable
0.8 - 1	Industrial	
2		Probable complaints
5		Serious complaints

Long term deposited dust criteria established for residential areas in several overseas countries are typically 200 mg/m^2/day averaged over a month.

For a typical dust, with a mean particle size of 10 microns in diameter, a density of 2.5 grams/cc and a reflectivity of, say, 30%, then the equivalent effective area coverage from equation (A) is 0.84% EAC. It is interesting to note that the public response lies between objectionable and probable complaints.

Relationship between a sticky and dry surface

With windspeeds in excess of 1.5 m/s few particles of aerodynamic

diameter greater than 20μ will remain on a smooth dry surface. However, the sticky collector will retain such particles.

Tests show that the amount of dust remaining on a dry surface as opposed to a sticky collector depends upon the percentage of particles greater than 20μ and the weather conditions. (Tables 3 and 4).

Table 3

Percentage of particles remaining on a dry rather than sticky surfaces for windspeeds over 1.5 m/s

Diameter μ	*% Remaining on dry collector*
<20	95
20-50	25
>50	<5

Table 4

Relationship between sticky and dry surfaces – % EAC

Weather Conditions	*Ratio*
wet	2 : 1
dry	6 : 1

Conclusion

The improvements described have been found useful in increasing the effectiveness of the sticky pad method for assessment of dust nuisance. Together with the formulae and procedures given, it is possible to make estimates of the gravimetric deposition rate as well as the airborne particulate concentration.

The techniques described in this paper are not intended to replace more sophisticated measuring techniques, but to complement them by enabling additional measurements to be made at other locations.

Reference

Beaman, A.L. and Kingsbury, R.W.S.M. 1981.
Assessment of Nuisance from Deposited Particulates Using a Simple and Inexpensive Measuring System. *Clean Air,* Vol. 11, No. 2. pp 77-81.

INDUSTRIAL NEWS

Working with Asbestos

The Chairman of the Health and Safety Commission, *Dr. John Cullen*, has warned people involved in asbestos removal work to get licensed by the Health and Safety Executive (HSE) or face going out of business.

From August 1, the asbestos laws are being tightened. Those involved in asbestos removal will not only need an official HSE licence but must also arrange medical checks on workers. New control limits for asbestos in the workplace also come into force.

Full details of licensing procedure are available from area offices of the Health and Safety Executive. Companies properly equipped and competent to do the work should have no difficulty in obtaining a licence.

To date, the Asbestos Licensing Unit has received over 700 applications but many other firms — including demolition contractors, thermal insulation engineers, air conditioning specialists, electricians, and plumbers just don't realise that the new laws apply to them.

Without a licence, firms could face heavy fines or in some cases even jail.

New control limits for asbestos

From 1 August 1984 the new control limits will be:

Blue asbestos	(crocidolite)	0.2 fibre/ml
Brown asbestos	(amosite)	0.2 fibre/ml
White asbestos	(chrysotile)	0.5 fibre/ml

Exposure of workers to asbestos should be reduced to as low a level as reasonably practicable and should never exceed the control limits.

Further information for contractors working with asbestos is contained in *A guidance to the Asbestos (Licensing) Regulations 1983* ISBN 0 11 883737 0 available from HMSO, price £2.75.

The Fluidised Bed Combustion of Waste Lubricating Oil

Waste lubricating oil from automotive engines is a potentially valuable resource as a source of heat. At present many vehicle servicing centres have their waste oil collected by specialist refiners, but receive only a small payment in return. Yet these same centres often use fuel oil for space heating so it is worth asking why they do not burn the waste lubricating oil on the premises.

The answer is simple. Until now there has not been an environmentally acceptable method of burning the oil unless it is mixed with a much larger quantity of normal fuel oil. The waste oil contains a range of toxic metals which are present as either additives to the oil or to the engine fuel. For example, a significant proportion of the lead in gasoline ends up in the lubricating oil, and any combustion process burning the used oil must take due regard of the metals in the oil.

BP have been involved in the development of fluidised beds for many years and the technology that has been acquired is

licensed by a subsidiary called Combustion Systems Limited. A fluidised bed can be thought of as a mass of inert particles, for example sand, beneath which air is injected in such a way as to agitate and mix the particles. Under the appropriate conditions almost any combustible material can be burnt in a fluidised bed with a high combustion efficiency. The heat released can be used to raise steam, heat water or provide hot air by varying the design of the heat transfer surfaces in the unit.

One particular area of research for BP has been looking at ways to retain trace elements in the fuel upon the bed material so as to prevent these elements being released to the atmosphere during combustion. Tests carried out by BP on a small package boiler rated at 120 kW over several hundred hours have shown that up to 80 per cent of the metals in the fuel can be retained in the bed. These tests used waste lubricating oil which had been collected from nearby garages as the fuel and the oil contained many metals, particularly lead and zinc. By using a special bed material made of alumina and silica, at the end of the test the bed material contained about 15 per cent by weight of metals which had been extracted from the oil during combustion.

Thus BP has the knowledge and experience to design a unit to raise heat from the combustion of waste automotive lubricating oil. If a service centre produced 50 litres of used oil each day and burnt it all, then the saving in fuel oil would be around £2,600 per year. It can be seen, therefore, that the potential savings are substantial if the waste lubricating oil can be burnt to provide heat on the premises. This can now be done cleanly using the fluidised bed combustion technology developed by BP.

Reader Enquiry Service No. **848**

BSI Test Facility for Environmental Performance

The Photometric Laboratory of the BSI Test House has recently expanded its test facilities for environmental performance and is now fully equipped to perform International Protection (IP) tests for protection against ingress of solid objects, dust or liquid on enclosures and electrical products. IP classification is recognized internationally and the new facility will be of interest to companies and organizations whose products may lie outside the fields of lighting and photometry, such as switch enclosures, distribution board enclosures, switch pads and optical enclosures.

The IP classification system specifies the degree of protection that an enclosure provides, both to personnel against contact with live or moving parts and to equipment against the ingress of solid foreign bodies or liquid. There are seven classifications for ingress of foreign bodies, ranging from no protection to dust-tight, and nine classifications for ingress of liquid, ranging from no protection to pressure water-tight. The laboratory has all the necessary equipment to carry out these tests, including a newly manufactured in-house rain machine.

Reader Enquiry Service No. **849**

Cyclone Separators Pocket New Benefits

A range of compact, highly-efficient cyclone separators is being marketed by a National Coal Board subsidiary with wide experience of environmental control techniques.

New units offered by NCB (Coal Products) Limited's External Engineering Services have been jointly developed by the industry's Coal Research Establishment and University College, Cardiff.

Vortex cyclone pocket (VCP) separation utilises pockets around the periphery of a cyclone chamber which create a vortex action, drawing in particulate matter and removing it from the main stream.

Manufactured under licence from the NCB, these systems (which are the subject of a UK patent application) offer improved particulate separation compared with conventional cyclones of similar size — with consequent benefits in cost-effectiveness.

Greatly-improved efficiency in extracting particles below 10 microns — especially pronounced in the minus five-micron range — enables VCP systems to compete with wet scrubbing or bag filtering, expensive alternatives with capital costs up to ten times greater.

In addition to its suitability for grit arresting and dust collection from coal-fired plant the technology can readily be applied to a wide range of industrial processes, including replacing more expensive plant for product collection after spray-drying or pneumatic-conveying.

Reader Enquiry Service No. **8410**

Welsh Vet Finds Clean Air Answer to Health Problems

Veterinary surgeon John James, MA Vet., MB, MRCVS, of Llantwit Major, South Glamorgan, has been experimenting with the use of electrostatic air cleaners in a wide range of animal houses. He has found that reduced dust levels prevent respiratory diseases in horses, pigs, poultry and cattle.

He used a laser densiometer to measure air pollution and found that dust levels in buildings where animals frequently suffered from respiratory diseases were often over 200 mg/m^3. Reducing the dust level to below 20 mg/m^3 by the use of an electrostatic air cleaner reduced the incidence of health problems and markedly increased the effectiveness of medication.

The air cleaners were supplied by Tepco (UK) Ltd., 29 Portmanmoor Road Industrial Estate, East Moors, Cardiff. They are available with air flow capacities ranging from 250 to 8500 m^3/hr (150 to 5000 cfm) to suit buildings of different sizes. These units collect particles as small as 0.03 microns and can thus collect bacteria as well as dusts, fumes etc., although they are more usually used to ensure clean and safe conditions for humans working in dusty environments.

Mr. James reports particular success in the use of the air cleaners to prevent virus pneumonia in calves and in treating chronic obstructive pulmonary disease in horses.

Tests showed that dust levels of an occupied horse box were cut by nearly 70 per cent within four hours of the air cleaner being switched on and by over 90 per cent within a day.

Owner Mrs. Fiona Livermore commented that her horses had frequently suffered from respiratory problems until a Tepco air cleaner was fitted in her stables under the guidance of Mr. James. "Since then the animals have been fitter than I've ever known them. They are a real pleasure to look at now and they are never short of breath even if we hunt all day", she said.
Reader Enquiry Service No. **8411**

CLEAN AIR

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nsca

52nd CONFERENCE and EXHIBITION

14–17 OCTOBER 1985

SCARBOROUGH

WRAPPING IT UP

..... but not in time for Christmas. Apologies for the late arrival of this bumper issue which combines Numbers 3 and 4 of Volume 14 – and a belated New Year's greeting to all our readers. Normal service will be resumed with the first issue of 1985, which will be published at the end of March and which will contain the results of our survey on straw and stubble burning during the 1984 Harvest. There is more on agricultural pollution in this issue, with an article on aerial crop spraying.

The Society's October Conference highlighted many topical issues, and as usual the audience made a major contribution via the discussion periods to the wisdom and experience to be garnered from the event. Unfortunately, there was obviously insufficient time for Whitehall's mandarins to digest the many clean air concerns raised in Brighton – for the Government's Response to the 10th RCEP Report contained the astonishing statement that "Clean Air is now a fact in our city centres." Would that it were!

Despite the sterling work of local authorities up and down the country implementing smoke control and the combined efforts of local and central government, and industry itself, to curtail industrial pollution, our city centres are far from enjoying truly clean air. There are some smoke control laggards, and industry is not always stainless. And of course, as the Greater London Council's Scientific Branch has ably demonstrated, traffic smoke and emissions have a substantial local impact.

Government acknowledges that there is "considerable scope" for improving the constructions standard for smoke (from new vehicles): a hollow victory for us unless a positive initiative is taken by the UK to change the EEC Directive. In any event, that admission alone makes nonsense of the complacent reflection on the air quality of our cities. We must hope that DOE's current surge of inward contemplation results in a more logical, structured approach to environmental protection: one in which clean air achievements are given due, but not preposterous, credit (and that credit given where it *is* due), and which looks to achieve a solution to *today's* problems. Although, without a strategy for energy use, it is difficult to see how this can be done.

UNIVERSITY TRAINING IN AIR POLLUTION CONTROL

by
Harold M. COTA

INTRODUCTION

It is helpful to know where both training and research in air pollution control are carried out around the world. This has been documented in the United States and Canada in several studies (1,2). Dr. Christopher Barthel and the staff of the National Clean Air Society (and the International Union of Air Pollution Prevention Associations) recently collected information on UK universities offering 3-year degree or postgraduate courses in environmental subjects (3).

OBJECTIVE

This paper summarizes information on what training is currently being done in the United States and expands Barthel's work. Questionnaires were sent to faculty around the world.

RESULTS

In the United States 160 Colleges and Universities responded by completing questionnaires in 1982 and 1983. Many universities offer one or two courses in air pollution control. The number with more extensive programs is limited. The academic programs are centered in many different departments. Details on curriculum are covered elsewhere (1, 4, 5, 6). Most schools indicated they have from 1 to 5 research projects related to air pollution. Academic programs with air pollution control training were identified in many other countries. The training in these countries was centered in schools of Engineering, Environmental Science, Geography, Medicine and Agriculture (7). Detailed information on the programs in other countries was not obtained because it was desired to keep the questionnaire as short and uncomplicated as possible. A complete list of the results is given in Appendix A and Appendix B.

CONCLUSIONS

It is clear that air pollution is a subject being studied and taught at universities world wide.

It would be useful for the faculties to know what type of work is going on in other countries. This information will be useful to prospective students and employers such as control agencies and industry.

It must be recognized that this study is *not complete.* It is hoped that by publishing these results the present effort can be expanded. It would be helpful if the reader would let the author know of any errors or omissions in Appendix A or B. In addition, it would be helpful if graduates of universities not included in the Appendixes let this author know. This can be done by either completing (a copy of) the questionnaire in Appendix C or sending the name of the Faculty involved in the programme and the complete address.

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APPENDIX A

U.S. UNIVERSITIES WITH AIR POLLUTION CONTROL TRAINING

STATE	*UNIVERSITY*	*DEPARTMENT*	*U**	*G***	*RES+*
Alaska	U of Alaska-Anchorage	CE	0	1	0
Arizona	Arizona State U	CE	0	1	-
	U of Arizona	ME	2	2	1
California	Cal Poly Pomona	Aero Engr	3	1	1
	Cal Poly San Luis Obispo	CE & EnvE	8	5	1
	California Inst of Tech	EnvE Sci	0	5	-
	Humboldt State U	EnvR E	2	0	-
	Stanford U	ME	1	1	-
	U California-Los Angeles	CE	3	1	1
	U of California-Berkeley	CE,ME,ChE,Chem	2	10	-
	U of California-Davis	CE	3	7	-
	U of California-Irvine	ME	3	3	-
	U of California-Riverside	Env Sci			
Colorado	Colorado School of Mines	Env Sci Ec Eng	1	2	1
	Colorado State U	AtmSci ME	0	3	1
Connecticut	U of Hartford	ME	1	0	0
	U of Delaware	CE,ChE	1	1	-
Florida	Florida Inst of Tech	Env Sci & Engr	3	3	1
	Florida International U	CE-Env Tech	1	4	-
	U of Central Florida	CE & Env Sci	1	1	1
	U of Florida	EnvE Sci	1	5	1

STATE	UNIVERSITY	DEPARTMENT	U*	G**	RES+
Hawaii	U of Hawaii-Manda	Engr	0	2	0
Idaho	U of Idaho	ChE,Chem	3	0	1
Illinois	De Paul U	Chem	1	0	1
	Illinois Inst of Tech	EnvE	1	7	-
	Northwestern U	CE	0	1	-
	S. Illinois U-Carbondale	ThE-EnvE	3	1	2
	S. Illinois U-Edwardsville	EnvSt			
	U of Illinois-Chicago	PH,Env & Occ H Sci	1	5	2
	U of Illinois-Urbana	CE	1	9	2
Indiana	Purdue U	CE,ME	3	3	1
Iowa	U of Iowa	CE & EnvE	2	2	-
Kansas	U of Kansas	CE	1	3	1
Kentucky	Eastern Kentucky U	EnvH Sci	3	0	0
	U of Kentucky	ChE	1	1	1
	U of Louisville	ChE,EnvE	1	1	-
Louisiana	McNeese State U	Bio, Env Sci	2	1	1
	The John Hopkins U	EnvH	0	4	2
	U of Maryland	Met	3	1	1
Massachusetts	Harvard U	PH	0	6	-
Michigan	Ferris State College	EnvQ Con	1	0	1
	Michigan State U	CE & SE	0	3	2
	Oakland U	Chem	1	0	1
	Wayne State U	ChE	0	5	-
Minnesota	U of Missouri-Rolla	CE	0	2	-
	Washington U	ME	2	2	-
N. Carolina	Duke U	CE & EnvE	1	1	-
	N.C. State U	ChE, Air Cons	2	5	2
	U of N. Carolina-Chapel Hill	Env Sci & Engr	0	8	1
New Jersey	N.J. Inst. of Tech	CE & EnvE	10	9	-
	Rutgers U	Env Sci, Met	1	3	1
New York	City Coll of CUNY	CE	0	3	-
	Cooper Union	Engr	9	0	-
	Cornell U	CE,ChE	0	2	-
	Manhattan College	ChE	0	1	1
	New York U-Medical Center	Inst Env Med	0	4	2
	Polytechnic Inst. New York	ChE	0	0	1
	Rensselaer Poly Inst	CE-EnvE	1	3	-
	SUNY Oswego	Erth Sci	1	0	1
	Syracuse U	CE	0	1	-

STATE	UNIVERSITY	DEPARTMENT	U*	G**	RES+
Ohio	Hocking Tech College	Env Ind H	1	0	0
	Muskingum Area Tech College	Eng Sci	3	0	0
	Ohio U	ChE	1	1	1
	U of Cincinnati	CE & EnvE,ChE	1	14	3
	U of Toledo	CE	4	9	1
Oklahoma	East Central U	Env Sci			
	Oklahoma State U	ChE	0	1	1
	U Oklahoma	CE & EnvE			
Oregon	Oregon Graduate Center	Env Sci	0	6	2
	Oregon State U	ME	1	2	1
	Portland State U	ME	2	1	1
Pennsylvania	Carnegie-Mellon U	ME, CE	2	2	2
	Drexel U	Env St Inst	0	8	
	Lafayette Coll	Chem,ME,CE,Met. E	5	0	0
	Penn State U	ME,ChE,CE,Met	24	7	2
	U of Pittsburgh-GSPH	EnvH Sci	0	7	2
	Villanova U	ChE	0	2	-
S. Carolina	Clemson U	Env S Engr	1	3	2
S. Dakota	S. Dak. School of Mines & Tech	Inst of Atm Sci	0	1	1
Tennessee	East Tennessee State U	EnvH	1	2	-
	Tennessee Tech U	ChE			
	U of Tennessee-Chattanooga	ChE & Env Sci	1	1	
	U of Tennessee-Knoxville		1	5	2
	Vanderbilt U	CE-EnvE	2	3	-
Texas	Lamar U	Env Sci	2	0	-
	Texas A&M U .	Plant Pathology & Microbiology	0	1	1
	Texas Tech	ChE			
	U of Houston	Env Mg, ChE	1	2	1
	U of Texas-Arlington	CE	1	3	-
	U of Texas-Austin	CE			
	U of Texas-Dallas	Env Sci	0	5	2
	U of Texas-El Paso	CE	5	4	-
Utah	Brigham Young U	ChE, Thermochem Inst	1	0	1
	U of Utah	ChE	3	0	1
	Utah State U	CE & EnvE	1	2	1
Vermont	Norwich U	Engr & Env Tech	4	0	1
Virginia	Virginia Polytechnic Inst	CE	2	3	1
Washington	Washington State U	CE & EnvE	2	7	2
	U of Washington	CE	3	4	2

STATE	UNIVERSITY	DEPARTMENT	U*	G**	RES+
West Virginia	WV College of Grad St	-	-	-	-
Wisconsin	Marquette U	CE	2	0	-
	U of Wisconsin-Madison	ME	1	1	1

* Number of undergraduate courses
** Number of graduate courses
\+ Number of research projects: 0 = None
1 = 1 to 5
2 = 6 to 10
- = Not reported

ABBREVIATIONS USED

Aero Engr	Aeronautical Engineering
AtmSci	Atmospheric Science
CE	Civil Engineering
ChE	Chemical Engineering
Chem	Chemistry
Engr	Engineering
EnvE	Environmental Engineering
EnvInd H	Environmental & Industrial Health
EnvE Sci	Environmental Engineering Sciences
EnvH	Environmental Health
EnvH Sci	Environmental Health Science
Env Mg	Environmental Management
Env S Engr	Environmental Systems Engineering
Env Tech	Environmental Technology
Env & Occ H Sci	Environmental & Occupational Health Science
EnvQ Con	Environmental Quality Control
EnvR E	Environmental Resources Engineering
Env S	Environmental Service
Env Sci	Environmental Science
EnvSt	Environmental Studies
Erth Sci	Earth Science
Inst Env Med	Institute Environmental Medicine
Geo	Geography
ME	Mechanical Engineering
Met	Meteorology
Met. E	Metallurgical Engineering
Micro	Microbiology
PH	Public Health
SE	Sanitary Engineering
ThE	Thermal Engineering

APPENDIX B WORLD AIR POLLUTION CONTROL TRAINING

Country	*University*	*Number of Courses*		*Level of*	*Department*
		Undergrad	*Grad*	*Research* *	
Australia	U of Melbourne	0	2	C	Faculty of Engineering
	U of New South Wales	1	1	B	Chem
Brazil	U Federal de Minas Gerais	0	0	A	Depto. Engenharia Sanitaria
Canada	Mount Royal College	4	0	B	Chemical and Biological Sci
	U du Quebec C Montreal	0	1	B	Dept de Physique
	U of British Columbia	0	1	C	Chemical Engineering
	U of Toronto	1	5	C	Chemical Engineering
		2	8	B	Environmental Engineering
	U of Windsor	1	2	B	Chemical Engineering
	U de Sherbrooke	1	1	B	Chemical Engineering
England	Leeds U	1	0	C	Fuel and Energy
	The City U	1	0	B	Civil Engineering
	Trent Polytechnic	1	1	A	Dept. Building & Env Health
	U of Newcastle Upon Tyne	3	1	B	Civil Engineering
	U of East Anglia	1	0	B	Environmental Science
	U of Exeter	1	0	A	Chemical Engineering
	Univ of Lancaster	2	0	B	Environmental Science
	U of Salford	1	0	B	Chemical Engineering
	U of Southampton	0	0	A	Civil Engineering
	U of York	1	0	A	Biology
Finland	Lappeenranta U Technology	0	0	B	—
	U of Helsinki	0	1	B	Physics Department
	U of Oulu	2	2	C	Botany
Germany	Tech U Berlin	1	9	B	Fachgebeit Luftreinhaltung
	U Stuttgart	0	1	B	Abteilung Biologie
Holland	Eindhoven U of Techn	1	1	B	—
India	Andhra U	0	5	B	Meteorology
Japan	Res Inst for Poll Control	0	1	B	—
	Shizuoka U	1	1	C	Chemical Engineering
Mexico	U Autonoma-Azcapotzalco	-	-	-	—

Country	*University*	*Number of Courses* *Undergrad*	*Grad*	*Level of Research**	*Department*
Netherlands	Agricultural U	3	1	C	–
	Eindhoven U of Tech				
	U of Utecht	1	2	B	Psychology Lab
	U of Toernodiveld (in ecology)	1+	1+	C	Botanisch Laboratorium
New Zealand	U of Canterbury	0	1	B	Joint Center for En Studies
Poland	Agricultural U	1	1	B	Katedra Ochrony Shodowiska
	Technical U	6	8	C	–
Scotland	U of Strathclyde	1	0	B	Civil Engineering
Singapore	Singapore Polytechnic U	1	0	A	Maths & Science
Sweden	Swedish U of Ag Sci	0	0	B	Plant and Forest Protection
Taiwan	Academic Sinica	0	2	B	Institute of Physics
	Tungai University	2	0	B	–
Thailand	Asian Inst of Technology	0	Some	B	Environmental Engineering
Turkey	Ankara U	0	4	B	Pharmacy F. Toxicology
Yugoslavia	U of Ljubljana	3	1	B	–

*Level of Research

A = 0 projects
B = 1 to 5 projects
C = 6 to 10 projects

NEW NSCA PUBLICATIONS

The Society is producing a spate of new publications. Due for issue in the next few weeks are the NSCA REFERENCE BOOK and the GLOSSARY. (To those who ordered pre publication copies, apologies for the delay but they are worth the wait!) Full price on publication: £10.95 for the Reference Book; £4.85 for the Glossary.

A very useful new leaflet is AIR POLLUTION – KNOW YOUR RIGHTS. 6 pages of information on the law, in effect a handy citizen's guide. Price: 30p per copy, £3.00 per hundred, £19.00 per thousand. A leaflet on ACID RAIN (same price) will be issued shortly.

APPENDIX C QUESTIONNAIRE USED IN SURVEY

APCA EDUCATION DIVISION SURVEY UPDATE

PLEASE COMPLETE THIS QUESTIONNAIRE AT YOUR EARLIEST CONVENIENCE.

NUMBER OF DIFFERENT AIR POLLUTION COURSES TAUGHT LAST YEAR AT UNIVERSITY.

UNDERGRAD . . . . . GRAD . . . . . .

NUMBER OF AIR POLLUTION RELATED RESEARCH PROJECTS:

NONE . . . . . 1 to 5 . . . . . 5 to 10 . . . . . .

WHICH OF THE FOLLOWING FITS YOUR PROGRAM:

1. All students in major take one air pollution class
2. Students in major can elect to take air pollution classes
3. Students in major must take course covering air, water, & other pollution control
4. Students in which other majors will take one air pollution class:

*CE *ME *ChE *ENV *MET

HOW DO YOU FEEL YOUR PROGRAM WILL CHANGE IN THE NEXT FEW YEARS?

1. It will remain the same
2. It will be phased out
3. It will be combined with

Name . . . . . .

University . . . . . .

Department . . . . . .

Address . . . . . .

City . . . . . .

Country . . . . . .

THANK YOU.

PROF. HAROLD M. COTA
CHAIRMAN, CONTINUING EDUCATION DIVISION
APCA EDUCATION COUNCIL
CIVIL & ENVIRONMENTAL ENGINEERING DEPT.
CALIFORNIA POLYTECHNIC STATE UNIV.
SAN LUIS OBISPO, CA. 92407
U.S.A.

UPDATE

DIRECT FIRED WARM AIR SPACE HEATERS

Way back in 1983, the City of Edinburgh District Council first raised with the Society its concern that direct fired space heaters using natural gas or oil as the fuel could in some circumstances be causing undesirable air quality indoors. These heaters are in widespread use for heating large enclosed spaces, and rely on fresh air being drawn into the system, the air being heated by a burner, and the warmed air then being distributed into the building – along with the combustion products. A wide range of gases are thus emitted with nitrogen oxides and carbon monoxide being of major concern.

Since Edinburgh first raised the matter, the Secretary General has written to Ministers at the Departments of Health and the Environment and there has been correspondence on the subject with the East Midlands Division. After some considerable delay, the Hon. William Waldegrave, Minister of State of the Department of the Environment wrote to confirm that there is no specific mandatory design requirement for standard fired warm air heaters although the relevant British Standard (BS 5990, 1981) sets out safety and performance requirements, including concentration limits for CO, CO2, NOX and aldehydes. The Minister continued:

"Where these heaters are installed in workplaces, they are subject to the general requirement to operate safely under the Health and Safety at Work Act 1974 which also regulates their installation. Responsibility for enforcement lies with local Health and Safety Executive inspectors on a case-by-case basis."

Smaller heaters are of course covered by the Gas Safety (Installation and Use) Regulations 1984 which came into force on 1 November 1984. Building Regulation M3 applies to the installation of this type of heater and requires Local Authority relaxation for those with outputs greater than 60 KW.

The NSCA's Technical Committee has concluded that where difficulties arise with these heaters, it will frequently be as a consequence of bad maintenance and misuse. The Technical Committee is particularly interested to know whether Local Authorities have monitored carbon monoxide levels (or indeed the concentrations of other pollutants) in buildings where these heaters are installed and operating. Any such data (especially "before" and "after" figs.) would be useful to the Technical Committee in its further consideration of the problem and the Society would be grateful for inputs from Local Authorities and the Health and Safety Executive.

EEC AGREES LEAD FREE PETROL MOVE

At the end of November 1984, EEC Environment Ministers finally agreed the proposal put forward by the Commission that lead free petrol should be introduced throughout the Community and should be available for sale as from 1989.

Environment Ministers however failed to agree on the second part of the Commission's proposal, for the reduction of CO, Hydrocarbons and NOx emissions from motor vehicles. The British motor manufacturing industry in particular has raised strong objections to these proposals, which would eventually require European Community Member States to manufacture vehicles to approximately the current US standards (entailing the use of catalytic exhaust emission controls). The Society of Motor Manufacturers and Traders has stated that fitting 3-way catalysts to new vehicles would impose capital costs of £9 billion per annum and increase fuel consumption throughout the EEC.

The first stage of the Commission's proposals could be met by the introduction of lean burn engines, a new technology still in the development stage but which could, UK motor manufacturers anticipate, be introduced in time to meet the first stage of the Commission's proposals for a reduction in emissions. It is the second stage of the proposals, strongly urged by countries such as the Federal Republic of Germany, concerned about the role of NOx and hydrocarbons in the onset of forestry damage, which are proving a sticking point.

NOISE DIRECTIVES AGREED AT LAST

Nine years late, five EEC directives limiting noise emissions from construction plant and equipment were issued in November 1984. At the same time a separate proposal on lawnmower noise was also published (five years after such control was first proposed within the Commission).

The breakthrough was made possible after Member States agreed in September to a "framework" directive which set out harmonised approval and certification procedures for construction plant and equipment (OJ L 300, Vol. 27, 19 November 1984). This establishes an elaborate complaints procedure, which helps to overcome the objection that manufacturers might seek to have their equipment approved in a Member State which lacked the expertise to do the job properly, thereby gaining access to the entire Community market with defective equipment. The complaints procedure allows Member States to inform their partners if machinery that is approved is noisier than required by the series of "daughter" directives. Thereafter, the equipment concerned would be suspended or the approval withdrawn. If the defect is relatively minor, manufacturers might first be given an opportunity to remedy the fault. Disputes between Member States are to be resolved with the help of the Commission.

The framework directive takes effect from March 1986 and the five daughter directives — setting noise limits for compressors, tower cranes, welding generators, power generators and hand-held concrete breakers and picks, are to be brought into force at the same time. Each of these directives contains two sets of noise limits, one coming into force in 1986, with the second, more restrictive set taking effect in 1991. The directives also require the Commission to issue proposals (by 1989 at the latest) for further tightening of the noise limits; the Council will then have to agree them within 18 months. The new regulations will not interfere with current local authority powers under the Control of Pollution Act to deal with

construction site noise, since in each case Member States are permitted to regulate the use of the equipment concerned in "areas which they consider sensitive". However, this provision has to be exercised without discrimination against equipment manufactured in other Member States.

(Source: *ENDS Report 118, Nov. 1984)*

BRITAIN SAYS "NO" TO HEAVIER LORRIES

Many environmental groups objected when the government accounced, following publication of the Armitage report, that it would allow lorry weights to increase from 32 tonnes maximum weight to 38 tonnes. But the European Commission proposal that lorry weights should be standardised throughout the Community at a maximum 40 tonnes weight has proved unacceptable even to the British government, which has now dug in its heels and refused to budge from its earlier declared maximum of 38 tonnes.

CALL FOR PAPERS
7th World Clean Air Congress, (IUAPPA) Sydney, Australia, 25 – 29 August 1986

The organisers of the 7th World Clean Air Congress (the Clean Air Society of Australia and New Zealand) have issued a call for Papers.

As is usual procedure with IUAPPA World Congresses, individuals wishing to submit papers should send a summary to the National Programme Committee formed within each National Association member of IUAPPA. The National Committees make an initial selection before presenting proposals to the International Programme Committee.

UK authors should send abstracts to the Secretary General, National Society for Clean Air (Chairman of the National Selection Committee), 136 North Street, Brighton BN1 1RG, **by 3 May 1985.** The National Committee will be forwarding selected abstracts to the International Committee at the end of May, and authors will be advised of their acceptance in July 1985.

A "Call for Papers" brochure with full details of requirements should be enclosed with this issue. If not, details can be obtained from the NSCA in Brighton, telephone Brighton (0273) 26313.

In brief, abstracts or outlines of pages should run to no more than two pages A4 typed, double spacing. Themes are as follows: Policy Formulation, Administration and Economics; Effects of Air Pollution; Air Pollution, Administration and Economics; Effects of Air Pollution; Air Pollution Meteorology; Atmospheric Science; Air Pollution Monitoring; Air Pollution Control – Industry – Motor Vehicles – Commercial/Domestic.

Proposals from authors residing in countries where IUAPPA is not represented should be addressed to: The Secretary, 7th World Clean Air Congress, Conventions Dept., G.P.O. Box 489, Sydney, N.S.W. 2001, Australia.

AERIAL CROP SPRAYING

by Jane Dunmore

"Controls on aerial pesticide spraying are totally inadequate", Councillor Liz Solkhon told delegates in a submission to the 1984 Clean Air Conference. Cllr. Solkhon, who is Chairman of the Environmental Health and Control Committee of Brighton Borough Council, said that the Council's investigation of various local incidents had shown that the present notification procedure was being ignored. As a result, residents, schools, hospitals and local beekeepers were unable to take precautionary measures to protect themselves against spray drift. One incident in particular had caused great concer: a children's playing field in Brighton had been contaminated with a herbicide containing a skin irritant during the summer of 1984. Through the Clean Air conference, Cllr. Solkhon called for an early review of the whole practice of aerial crop spraying, and for effective controls to be introduced to give the public full protection.

The motion was referred to the Society's Parliamentary and Local Government Committee for consideration; at their November meeting, which coincided with the publication of the Food and Environment Bill, the P & LG Committee decided that the Information Officer should prepare a review of available legislative control options, together with the possibilities introduced by the Food and Environment Bill. This article draws on that review, updated by more recent information drawn from Parliamentary debates and other details kindly supplied by Chris Rose of Friends of the Earth.

The extent of the problem

Although aerial spraying of arable land accounts for just 2 - 3% of pesticides applications, there are an estimated 150,000 aerial applications per annum. (This figure is calculated from the known figure of 153 complaints made to the Civil Aviation Authority (CAA) in 1983, and the Ministerial answer to a Parliamentary Question, that "only one complaint is made to the CAA for every 1,000 operations undertaken"; it can be compared with the estimated 100,000 applications quoted in RCEP's 1979 report.) 44 spraying firms hold aerial application certificates, with over 100 aircraft being operated.

Aerial spraying is far more likely to cause problems of spray drift than other methods of application. Droplets suspended in the air have longer to evaporate to a size where they drift uncontrollably (and about 25% of the spray volume may already be in this size range), and can form an ultra-fine aerosol of superconcentrated pesticide. According to Friends of the Earth, who are producing a dossier of cases of people who have suffered loss or damage to their property or health as a result of pesticide use and abuse, aerial spray drift causes widespread "pesticide 'flu" when organophosphorous pesticides are applied in cereal growing areas in the spring.

The Soil Association, in a special report on the spray drift problem published in August 1984, says:

"Aircraft are being used increasingly to treat larger fields and even under ideal conditions crop scientists believe that the drift problem from planes and helicopters is ten times worse than from ground sprayers. In practice, crop spraying pilots are all too often "cowboy" operators, taking little notice of weather conditions or exactly where they spray."

The 1979 Report – *Agriculture and Pollution* – by the Royal Commission on Environmental Pollution criticised the control arrangements for aerial spraying. Their report says:

"We have seen accounts of the dealings of members of the public, or even local authorities, with the official bodies involved which suggest a lack of clarity in responsibilities for dealing with incidents."

The Royal Commission also stated:

"... we think that incidents in which people are subjected, or believe that they are subjected, to pesticide spray, cannot be discounted even if it is subsequently shown that their fears were groundless. To be exposed unexpectedly to a spray of some unknown substances is bound to cause anxiety. We have found it particularly worrying that people who believed that they had been sprayed have found it difficult to identify the substance involved, to ascertain whether or not it was harmful and to discover what remedial action they should take."

Present Controls

All crop spraying chemicals are products which should have been cleared for use under the Pesticides Safety Precautions Scheme (PSPS). 98 chemicals in several hundred formulations are currently cleared for aerial application under the PSPS. In addition to PSPS clearance, the application and use of these products are subject to the provisions of the Health and Safety at Work Act 1974, the Poisonous Substances in Agriculture Regulations 1984, and, in the case of aerial applications, to the Aerial Applications Certificate which is granted to an operator by the Civil Aviation Authority (CAA) under article 40 of the Air Navigation Order 1980. The CAA requires that aerial sprayers restrict chemicals to the target area by, *inter alia*, only spraying when wind speed is within maximum permitted limits (normally 10 kt). There is a requirement to maintain minimum distances from houses and sensitive areas (e.g. schools, hospitals, children's playgrounds). Operators must consult the Nature Conservancy Council before spraying near national nature reserves or sites of special scientific interest; operators must give advance warning to Chief Constables, hospitals, schools etc. in the area, and "as far as is practicable", to nearby residents and other owners of land adjoining area to be sprayed. The CAA consults the Health and Safety Executive (Agricultural Inspectorate) whenever any question of observance of the general duties under section 3 of the Health and Safety at Work Act is raised. In the past three years, there have been four prosecutions under the HSW Act for offences involving aerial spraying, three of which were successful. Following up the 153 incidents reported to them in 1983, the CAA took two prosecutions, one of which was successful.

Current controls are to be tightened somewhat next year. According to Transport Minister Michael Spicer in a written Parliamentary reply (December 1984) the minimum

horizontal distance which aircraft must maintain from houses will be increased from 75 to 200 feet. Aircraft will have to fly at least 200 feet above gardens. Even these more stringent requirements will not bring the UK into line with other European countries. In another written answer, Mr. Spicer disclosed that crop spraying planes in Belgium must maintain distances of 2000 metres from dwellings and 300 metres from single buildings; in Denmark the minimum distance from dwellings is 300 metres, in The Netherlands, 100-150 metres, and in Germany (FR), between 50-100 metres from other fields and objects. Only Eire has lower limits than the UK, allowing spraying within 15 metres of buildings.

Future controls – the Food and Environment Protection Bill

This three part Bill is basically an enabling measure, and provides for the protection of food in the aftermath of a release of harmful substances (Part I), replaces the Dumping at Sea Act 1984 (Part II) and makes provision for regulating the supply and use of pesticides (Part III). Part III will replace the voluntary controls under the PSPS with a statutory system of control over both the approval of pesticides for use in the UK and their use, including applications. On the face of it the Bill will enable Ministers to impose stringent controls on aerial spraying of pesticides, and indeed to ban this form of application in certain circumstances, if necessary. The lack of detail in the Bill makes it difficult to comment more specifically before the details of draft regulations have been released, but in the Committee Stage debate in the House of Lords, the Minister, Lord Belstead, told the House in response to a specific question from Lord Craigton, that Ministers would be empowered under the Regulations attaching to the Food and Environment Bill to say that there should be no aerial spraying at all in a certain area and/or for a certain period.

Part III, Clause 15 of the Bill would provide Ministers with the power to impose conditions before pesticides are approved under a statutory scheme; those conditions will require evidence not only of the safety of products, but also of their efficacy. To quote Lord Belstead: "The intention is to ensure that no pesticide will be put onto the UK market unless it is demonstrably beneficial to agriculture, horticulture or public health." It is also under Clause 15 that statutory controls would be extended over the use, including the application, of pesticides.

The remaining clauses in Part III provide basically for "good housekeeping" powers. Clause 16 would enable Ministers to charge fees to persons seeking approval in order to recover the costs of scrunity and assessment, and Clause 17, together with Schedule 2, provides the powers necessary to enforce the provisions. Enforcement will entail additional staffing at the Health and Safety Executive (18 extra staff will be taken on to enforce statutory controls over pesticides use), and 16 more staff are to be allocated to MAFF. While regulations will make the enforcement position clear, it is already apparent from the Bill that there is no intention for Local Authorities or their officers to play a significant part in enforcing the Part III provisions. Schedule 2 hints at the possibility of LA officers acting as agents of HSE Agriculture Inspectors; but unless they were specifically appointed as investigating or enforcement officers, i.e. authorised by the

Ministers to exercise the powers conferred under Clause 17, LA officers would only be able to act as assistants, under supervision.

The definition of pesticides in the Bill appears to be sufficiently wide to cover the range of pesticides, herbicides, fungicides etc. that are applied to land; it includes substances or preparations used not only for destroying organisms harmful to plants, undesired plants or harmful creatures, but also for protecting and regulating the growth of plants, etc.

The case for a ban

Most of the noble Lords who have taken part in debates on the Food and Environment Bill have lent their support to far stricter controls on aerial spraying of pesticides, and many have called for a complete or partial ban on aerial spraying. The consensus view was expressed by Lord John-Mackie, who said that aerial spraying should not be banned completely, since both forestry and bracken on hillsides required that method. He suggested however that a farmer should have to justify the need for aerial spraying on arable land. Speaking as a farmer, Lord Walston said that it was now perfectly possible, with the advent of the modern type of sprayer, to spray adequately without having recourse to aerial spraying of any kind. Lord Walston also supported the introduction of a complete prohibition on aerial spraying of farms, as did Lord Craigton.

Lord Melchett said that from his personal experience of aerial spraying it was quite impossible even with the greatest care in the world to prevent the discharge landing where it was not meant to go: for example, on hedgerows, public roads and other places. He said:

> "It seems to me that there is a widespread consensus in all parts of the House that there is very little, if any, justification for aerial spraying so far as arable farming is concerned; and that would be my view. It may well be that a licensing system would be needed for particular applications for forestry purposes or for bracken control."

The National Farmers' Union (NFU) believes that there is scope for tightening up the operation of aerial spraying and that a review of the range of products cleared for aerial applications would be timely.

The NFU says that in some exceptional circumstances in the farming calendar, aerial spraying may be the only option e.g. when crops are threatened near harvest time when speed is of the essence and when crops might be damaged by ground application using a tractor boom. (Tramlines allow tractor booms to be taken over a standing crop without damage, and that use is now widespread. In a few instances, e.g. when thorough coverage of potatoes is required near harvest, "tramline" movements would not be sufficient to ensure complete spray coverage. Low ground pressure vehicles are now available for ground applications where there is a risk of the land being churned up by heavy movement over it.)

While the NFU obviously believes that controls on aerial spraying can and will be

applied more tightly, it has so far rejected the suggestion that aerial spraying should be licensed, or that aerial spraying of agricultural land should be banned. This position is currently being supported by the Government, but the strength of feeling on the issue among Peers, MPs, environmental groups and other organisations such as Women's Institutes may yet cause Ministers to have a change of heart.

13th INTERNATIONAL ASSOCIATION AGAINST NOISE CONFERENCE

Sarajevo, Yugoslavia

Between 28th May and 1st June 1984, I had the honour of representing the National Society for Clean Air at the above Conference.

Sarajevo – The Town

Sarajevo is one of the largest and most developed economic centres in Yugoslavia and is situated in a picturesque valley surrounded by mountains rising to 1600 metres. The town lies along a river and following the stream's flow one walks through areas which give a linear history of the various occupations ranging from Roman, Turkish, Serbo-Croatian, Austrian to the present Socialist Republic of Bosnia and Herzegovinia. The latest additions are the massive concrete blocks of flats erected for the Winter Olympic Games and now used as municipal housing.

The Conference

The Conference was held at the Skenderija Cultural Centre. Although the attendance was less than the Organisers expected, there were delegates from East and West European Countries and the United States of America. The Conference resulted in a useful technical interchange and it became apparent that there is much useful work that can be done to harness expertise, goodwill and energy in order to deploy resources cost-effectively.

NSCA Presentation

Surprisingly, the NSCA paper 'Noise Control Objectives in Today's Society' had been omitted from the programme but in the event, it was given pride of place in the full plenary session, immediately after the President's opening address. The paper was well received, evoked much interest and discussion, and led to a great deal of follow-up debate throughout the week. A number of delegates expressed great interest in the multi-disciplinary policy and activities of the NSCA and were obviously keen to get our Society more heavily involved in the international aspects of noise control.

Further actions

As a result of the NSCA Presentation, there emerged a strong body of opinion calling for a close and visible dialogue between the acousticians, politicians, planners and interested lay people. In order to make the best available use of resources, it seems desirable that

the planning of certain acoustic congresses be rationalised. This would allow experts to hold their own rather esoteric assembly where specialists can argue and refine scientific principles. The results of this activity can then be brought to the more broadly based multi-disciplinary meetings where the cost-effective application of expert knowledge may be debated by those who have to apply it while facing realities in economic, political or even emotional restraints.

In carrying out the latter activity, people clearly wished to learn from the experience of the NSCA.

On the technical front, there is clearly a desire and need to get to grips with the noise from transport and in doing so, to develop criteria to be used to exercise some control of annoying low frequency sound in the frequency range below 250 Hz.

Atmospheric Pollution

Whilst in Sarajevo, I took the opportunity of discussing atmospheric pollution with the official responsible for their very successful 'clean air campaign'. He explained that because of the surrounding mountains, Sarajevo is protected from winds, but does suffer from frequent and pronounced temperature inversions which trap any atmospheric pollution. The 'clean air campaign' has dramatically improved the quality of life, particularly during the winter months. It was achieved by 'stick and carrot' techniques which induced residents and industry to burn natural gas instead of oil or coal.

Those responsible are very keen to maintain dialogue with the NSCA and have asked that we send them details of our Annual Conferences.

A Personal Note

Representing the Society at this Conference was a very rewarding experience and I shall long remember the tap-tap-tapping of the copperbeaters' hammers as they produced exquisite artefacts in their tiny workshops in the Turkish quarter, and also the consequences of my failure to heed our Secretary-General's warning that an excess of plum brandy adversely affects the semi-circular canals!

Hylton Dawson
Chairman, NSCA Noise Committee

LETTERS

Professor R.S. Scorer has written in response to the letter from Dr. R. Russell-Jones (*Clean Air* Vol. 14, No. 2) questioning both the quoted evidence and consequent argument and, in a short final paragraph, also refers to the "slur on me and my scientific colleagues". While it has been decided that this correspondence should now close, members of the Society will know that Professor Scorer's outstanding record in furthering the cause of clean air over almost 40 years bears every inspection.

EDITOR

LONG TERM VARIATIONS IN SO_2 (AND SMOKE) LEVELS IN WEST LONDON

by

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ABSTRACT

Major anomalies are observed in the gradual decrease of average winter levels of SO_2 over the period from 1961/2 to 1975/6. In the early sixties, the anomaly is clearly correlated with the coldness of the winters. The second anomaly — late sixties to early seventies — is shown to reflect a changed pattern in fuel usage in one sector of the community. This factor is seen also to affect summer SO_2 levels during the same period, although the direction of the incoming air stream is generally the major determinant in summer. Influences of other meteorological variables are also considered.

A re-examination of averaged urban levels of SO_2 in the UK reveals a strong correlation between monitored levels and *total* emissions. This, and other information, indicates that high level emissions are probably of more importance in determining ground level concentrations than has generally been thought to be the case. In particular, an estimate is given in which the contribution of power stations to monitored SO_2 levels is about 20%. Attention is drawn to the frequently ignored effect of high level emissions from distant locations.

INTRODUCTION

Of the innumerable publications relating to air pollution, those dealing with ambient levels have mainly been concerned with methods of measurement, the collection of data and the fitting of mathematical models. Such studies tend to span periods of one to three years, and, in the area of concern to the authors (viz. sulphur dioxide and smoke), the objectives and outcomes have varied. Earlier works[1,2] provided an insight to the relationships between observed levels and meteorological variables, whilst some later studies[3-7] have attempted to refine these ideas. Other investigations have also sought to use practical empirical models for forecasting, with a view to the prediction of high levels episodes[8]. Finally, in conjunction with emission inventories, modelling has been used as an aid to future planning[9,10].

Investigations of longer term variations in SO_2 and smoke levels (of the order of ten years) tend to be fewer. Although there is the potential for longer term decision-making on the basis of extrapolation (particularly when used in conjunction with emission data), this has generally not been the primary concern. Undoubtedly, the best known records of longitudinal data are the National Survey of Air Pollution 1961-71[11] and the subsequent publications of monitored levels (annual)[12] and emissions (periodic — see ref. 13, for example). In the original publication[11], however, the purpose of presentation of the monitored data was to show the progress of the pollution abatement program under the

Clean Air Act. Smoke control was clearly seen to be effective by the dramatic decrease in the average, monitored, national levels and the more-or-less parallel decrease in the annual emission inventories confirmed the cause and effect. Sulphur dioxide levels decreased less rapidly, but in line with the fall in domestic emissions. Over the same period, industrial emissions remained approximately constant while emissions due to power generation rose markedly and overall there was a steady increase. (It is interesting to note the recently observed sharp increases in smoke and SO_2 levels in Dublin which reverse an eight year trend and which appear to arise from the greatly increased use of coal for household heating[14]).

Auliciems and Burton[15] have also commented on the long term variation in smoke levels in the U.K.

Long term trends in SO_2 levels have been investigated near Rotterdam[16] and in the Sheffield region[17].

In the Rotterdam study (Winters, 1961/2–1973/4) van Dop and Kruizinga[16] observed the mean annual SO_2 levels to essentially decrease linearly. This linearity was simply ascribed to falling emissions. The overlaid fluctuations were attributed to meteorological variations and were shown to be highly correlated with a pollution index which depended upon stability at night, the daytime height of the mixing layer and the average surface windspeed. However, as Possiel and Frank subsequently pointed out[18], the data presented indicates an initial period during which emissions may have been relatively constant and the variation in SO_2 levels was primarily determined by meteorological factors, and, a later period during which changing emissions may have been the dominant factor. The strong downward trend in SO_2 levels over the entire period may have been fortuitous. Only with emission data could these questions be resolved.

In Sheffield (1968–1975), Garnett[17] found that sharp decreases in SO_2 levels for both summers and winters in 1970 and 1971 coincided with the changeover from high to very low sulphur content fuels by local industry. Seasons of unusual averaged conditions with respect to temperature, atmospheric stability, wind direction or speed were seen to coincide with some maxima and minima on the long term plots.

The use and interpretation of National Survey data has previously been discussed[19,20]. One indisputable fact is the extremely small usage of this data relative to the massive effort required in its collection and documentation. Our primary purpose in examining National Survey data[11,12] was to see if anything could be learned about the local atmospheric environment in the London Borough of Hillingdon (LBH) and the factors affecting it. An earlier paper dealt with variations in SO_2 and smoke levels on a daily basis for one year[7]. It was seen that net concentrations of air pollutants in an outer Borough of a large city are very dependent on the direction of the incoming air stream.

In this study we look at long term variations in SO_2 levels (in the main), for the winters from 1961/2 to 1975/6 and the summers in between. A survey of fuels usage was extended back as far as possible, the relative 'coldness' of each period was found[21] and the frequencies of occurrence of wind direction, wind speed and stability categories obtained[22].

The London Borough of Hillingdon lies on the western extremity of the Greater London area with its centre of Uxbridge approximately nineteen miles from and slightly north of west with respect to central London. It is transversed by several major roads (A4, M4, The Uxbridge Road and A40) and three rail lines, being roughly rectangular in

shape; about eleven miles north to south and approximately four miles east to west. Apart from the north-western corner of about one-sixth of the total which is largely undeveloped (cross-hatched), the LBH is probably best described as light industrial. Considerable light industry is located in the Ruislip-Eastcote, Uxbridge, Cowley, Hayes End, Hayes, West Drayton and Harlington areas. (See Fig. 1). The WSL/National Survey of Air Pollution classification of LBH monitoring sites was either: (i) commercial sites within areas of lower density housing or mixed density housing areas (4, Hayes and Harlington 4) or, (ii) lower density housing areas with at least twenty-five per cent open ground (1, Ruislip-Northwood 2; 2, Hillingdon 1; 3, Hayes and Harlington 2; 5, West Drayton 1). Previous measuring sites were classified in category (i). The most significant features of LBH are the relatively undeveloped regions to the north and west and Heathrow Airport which occupies the lower part of the Borough.

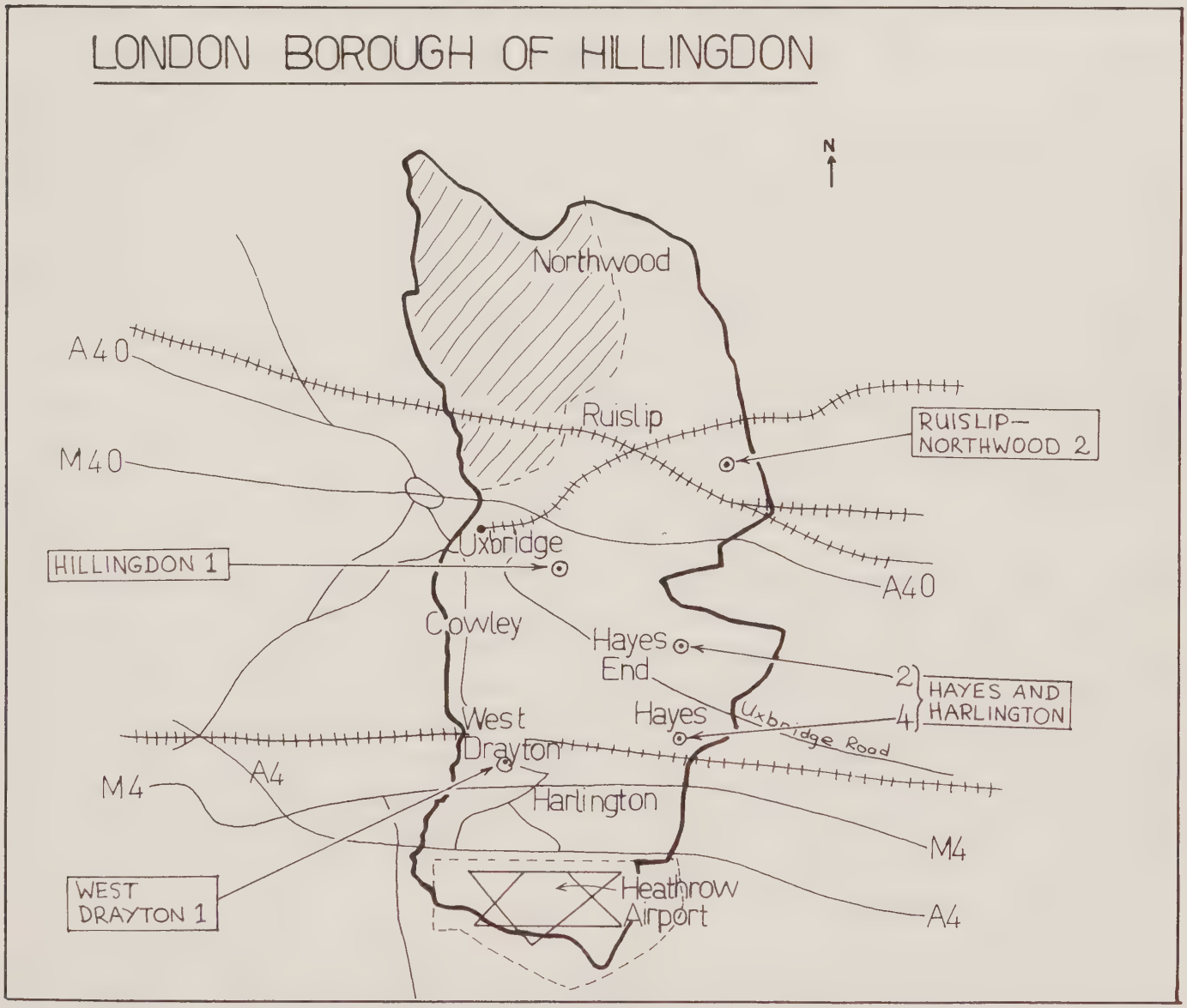

FIG. 1 The London Borough of Hillingdon and the locations of the National Survey monitoring stations.

STATISTICS

The degree of correlation of two variables depends not only upon relative order but also upon the magnitudes of differences between points in data sets. A statistic which takes

account of both of these aspects – that is, can be used in conjunction with continuous variables – is the frequently used Pearson's r. However, Pearson's r may only be applied to variables which (i) are linearly related and (ii) have a homoscedastic distribution[23]. Hence, for a valid application of the Pearson's statistic, it must be known that the scattered plot of the values of one variable (say, Y = pollutant level) versus the other (say, X = temperature) has a certain type of appearance. To satisfy (i), it must be possible to draw a single-section, straight line to represent the way in which Y varies with X. For a homoscedastic distribution, (ii) the scattered experimental points must fall symmetrically about the straight line of best fit and be enclosable by an elliptical shape (also symmetrically located about the straight line). Otherwise the distribution is described as heteroscedastic – as in fig. 7(a). In this case, the data points are well enough represented by the straight line (on average) and are symmetrically distributed about it. But the spread increases from lower left to upper right so that a line enveloping all of the points would form only half an ellipse and the use of Pearson's r would be invalid. Pollution levels vary in an inverse fashion with wind speed[2,7], rather than linearly. Therefore requirement (i) is not met in this case and again Pearson's r cannot be used. Hence in most instances it was necessary to use a different type of statistic. By ranking the values of one variable (say, Y = SO_2 level) from highest to lowest – for example, 9 down to 1 if there are nine years of values – and then doing likewise for the corresponding X values (say, tons of SO_2 emitted), it is possible to then calculate various, so-called, rank-order correlation coefficients. One of these is the Spearman coefficient, p. It is free of the constraints [(i) and (ii)] which apply to r and is relatively easily computed, but can underestimate the strength of correlation compared with r. Thus in one instance where conditions (i) and (ii) appear to be satisfied, but some inversions in rank order among a small number of data points lead to a value of p apparently in conflict with the strong quantitative relationship, r has been used.

Calculated values of any correlation coefficient must be compared with tabulated values which have been worked out by statisticians, at various levels of significance. When the calculated value is equal to or greater than the tabulated value, the calculated correlation is called significant at the corresponding level. Levels of significance are often given as 'fractions' (0.1, 0.05, 0.02, 0.01 and 0.001); the certainty of the two variables being non-randomly related would be 90%, 95%, 98%, 99% or 99.9% respectively. The 0.05 level of significance (95%) is generally accepted as highly significant. At the 0.02, 0.01, etc. levels of significance, the relationship between variables is demonstrated to be correspondingly stronger. Tabulated values of p were taken from ref. 24 and of r from ref. 23.

DATA AND DISCUSSION

THE BASE DATA

For the seasons under consideration (1961/2 to 1975/6), it is the variations in the 'whole town average'* concentrations of both pollutants that have been examined. Up to seven monitoring stations were operating during any season. The locations of the five monitoring stations responsible for the majority of the data are indicated in Fig. 1. Over short periods (days) there were sometimes large variations in pollutants' levels. These variations were removed by taking seasonal averages for each monitoring station. Between monitoring stations there were small differences, but as often as not these differences were not

consistent from season to season. What was generally consistent was the up or down turn of levels, for all stations from one season to the next — almost without exception.

(a) **Sulphur Dioxide.** Whilst levels varied a little from station to station — up to ±10% of the mean, but generally less than ± 5% — the pattern of variation was almost identical to (a) in Fig. 2 for the winters in each case. (The correlation between sites was significant at the 0.01 level for all pairs other than one. For this pair the significance level was 0.02). Hence no significant loss of detail is observed in the pattern of variations between seasons due to averaging over the monitoring stations. That the determinants of *variations* in SO_2 levels from season to season were common throughout LBH, is strongly indicated.

(b) **Smoke.** Variations in smoke levels from one monitoring station to another are slightly greater in the case of smoke, but again there is no significant loss of detail in the plot of the averaged concentrations.

MAJOR CORRELATIONS

Winters, 1961/2–1965/6, London Borough of Hillingdon

(i) **Sulphur Dioxide.** Examination of line (a), Fig. 2 reveals two periods during which the SO_2 levels rose from well below the trend line to maxima and then fell clearly below the trend line again. The first of these — between the 61/62 and 65/66 winters — is largely dominated by the excessively high levels recorded during the 62/63 winter. This was the extremely cold winter which has been recorded in English folklore and is confirmed in the high SO_2 levels apparent in comparable plots for locations throughout the U.K. (For example, see ref. 11, fig. 2.7 'Trends in regional sulphur dioxide concentrations'. Maxima generally appear for the year ending March 1963). For the five winters mentioned, there is a clear correspondence between coldness (number of degree days[21] (dd); Fig. 2, (c)) and the SO_2 concentrations ($[SO_2]$) recorded. In fact, for these five winters, Pearson's r ($[SO_2]$, dd) = 0.900 which is greater than the critical value at the 0.05 level of significance; $r_{0.05} = 0.878$.

(ii) **Smoke.** A similar relationship can be seen to exist between the smoke levels (Fig. 2(b)) and the degree of coldness for this period. r([smoke],dd) = $0.925 > r_{0.01} = 0.917$. This very high level of correlation indicates a strong cause and effect relationship, although the strength of association will be overestimated due to the effects of the smoke control program under the Clean Air Act. In addition to the successively warmer winters, which of themselves would require less coal to be burned — assuming a constant population level of invariable energy requirement per head and a steady level of industrial activity — the continued changeover from coal to smokeless fuels would also contribute to the fall in smoke levels. Unfortunately, the separation of these two factors cannot be

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* (See previous page)

The reliable seasonal means of National Survey of Air Pollution Data published by the Warren Spring Laboratory[12] for each reporting monitoring station, are the base data used in this study. "Whole town average" (WT) values are the arithmetic averages over all LBH stations for which data is so published. Hence summers are from April 1 to September 30 (inclusive), winters are October 1 to March 31 the following calendar year, and, "Pollution Years" are the period April 1 through to March 31.
All *concentrations of SO_2 and smoke are in the units of* ug m^{-3}

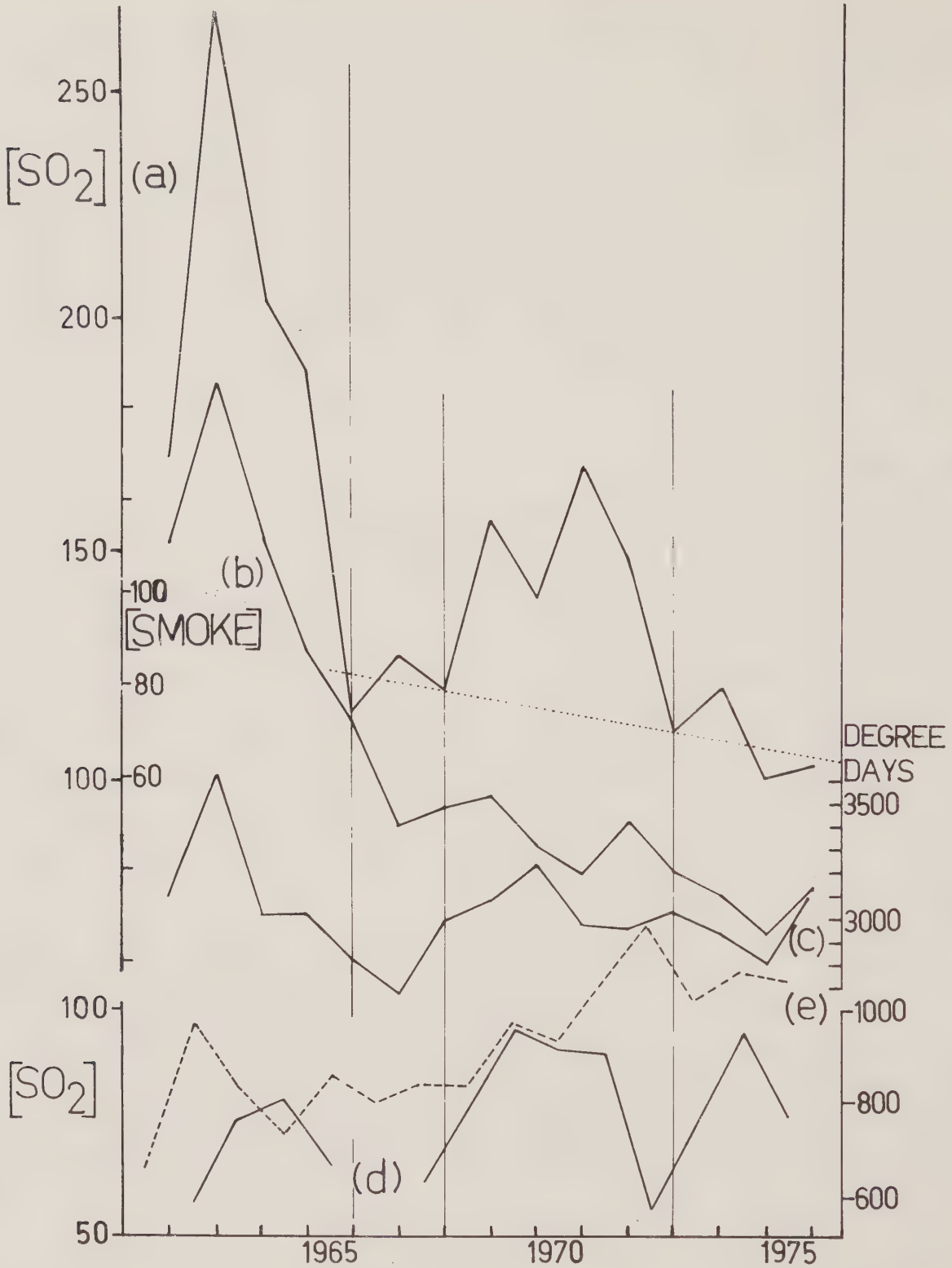

FIG. 2 LBH whole town seasonal average levels of pollutants ($\mu g\ m^{-3}$): (a) SO_2, winters, (b) smoke, winters and (d) SO_2, summers. Thames Valley degree days: (c) winters, (e) summers.

easily done. r([SO_2],dd) will similarly be overestimated. Furthermore, for both smoke and SO_2 meteorological factors will influence the strength of these correlations. (See – 'Other factors in sulphur dioxide levels, LBH' – page 116.)

Averaged Urban Levels in the U.K., 1958–1970

(i) **Sulphur Dioxide.** As mentioned in the introduction, (nationally-averaged) urban

SO_2 concentrations have previously been related to falling domestic emissions[11,25], the cause of which was traced to an approximately 50% decrease in the use of the major source of SO_2 (solid fuel) between 1950 and 1971. Over this extended time period, there seems to be no reason to doubt this causal relationship. However, during the period from about 1958–63, the downward trend in annual domestic SO_2 emissions is barely discernible, while the highly variable, annual average SO_2 concentrations show no clear trend at all. (These data from ref. 11 have been re-presented in Fig. 3, (a) and (b), for convenience).

For the later part of this period, and onwards, the Thames Valley, winter degree days are shown in Fig. 2(c) and have been included in Fig. 3 (c), to facilitate comparison. When compared, the correlation between this 'coldness' indicator and the national annual average [SO_2] can be seen to be virtually perfect for 1961–4. From about the year ending March 1964 onward, the extremely regular decreases in the domestic emissions are clear and the SO_2 concentrations vary about this line in a manner which very well reflects the relative coldness of successive years. That there should be a good correlation between a primary cause ((c); coldness of winter) and observable effect ((a); monitored [SO_2]), but a mismatch with the intermediate ((b); emission levels) is puzzling. In particular, the extreme coldness of the 1962/3 winter is clearly reflected in the annual, averaged [SO_2] for the year ended March 31, 1963, but is not in the annual domestic SO_2 emissions for either of the calendar years 1962 or 1963. However, when we consider the annual *total* SO_2 emissions, the mismatch disappears. In Fig. 4, a more valid comparison is made between (a) (Thames Valley) total degree days and (b) total average SO_2 emissions (em) for the calendar years 1962–70 inclusive. The correlation can be seen to be strong and r(dd,em) = 0.704 is significant at the 0.05 level. What may be concluded from this is that whilst the overall downward trend in UK urban SO_2 concentrations was determined by falling domestic (low level) emissions due to changing habits in fuels usage, large fluctuations about the trend line are related to the total SO_2 load in the atmosphere (total emissions), irrespective of course of height of emission. The data indicate the primary cause of these fluctuations to be the degree of coldness which determines the total energy requirement and fuels usage, and hence the total pollutants emitted.

That high level emissions make a contribution to local ground level concentrations (glc) has occasionally been disputed (see for example ref. 26), although many investigations have either conceded the possibility of some effect[27] or concluded that a minor contribution – dependent upon ambient meteorological conditions – does exist[28,29]. References 26–29 were concerned with the possible contribution of power stations to glc. Closer inspection of ref. 27 reveals that whilst "no statistically signficant effect due to SO_2 emissions could be detected against background emissions", the three estimates of detection limit indicate that up to about 18, 24 or 40% of ground level SO_2 could arise from the high level emissions. Using calculations from ref. 28, Jarman and de Turville[27] theoretically estimated a high level contribution to the glc. At the sites they investigated this 13 $\mu g\ m^{-3}$ would have been equivalent to between a 22% contribution at Fawley and 72% at Pembroke. Martin and Barber state[29] their findings to show effects of "typically only 10%". Clearly the effect would be considerably greater under unfavourable conditions. As will be seen in Figs. 5 (between winters 1967/8 and 1968/9) and 6 (between summers 1971 and 1972), it is conceivable that dramatic variations in average

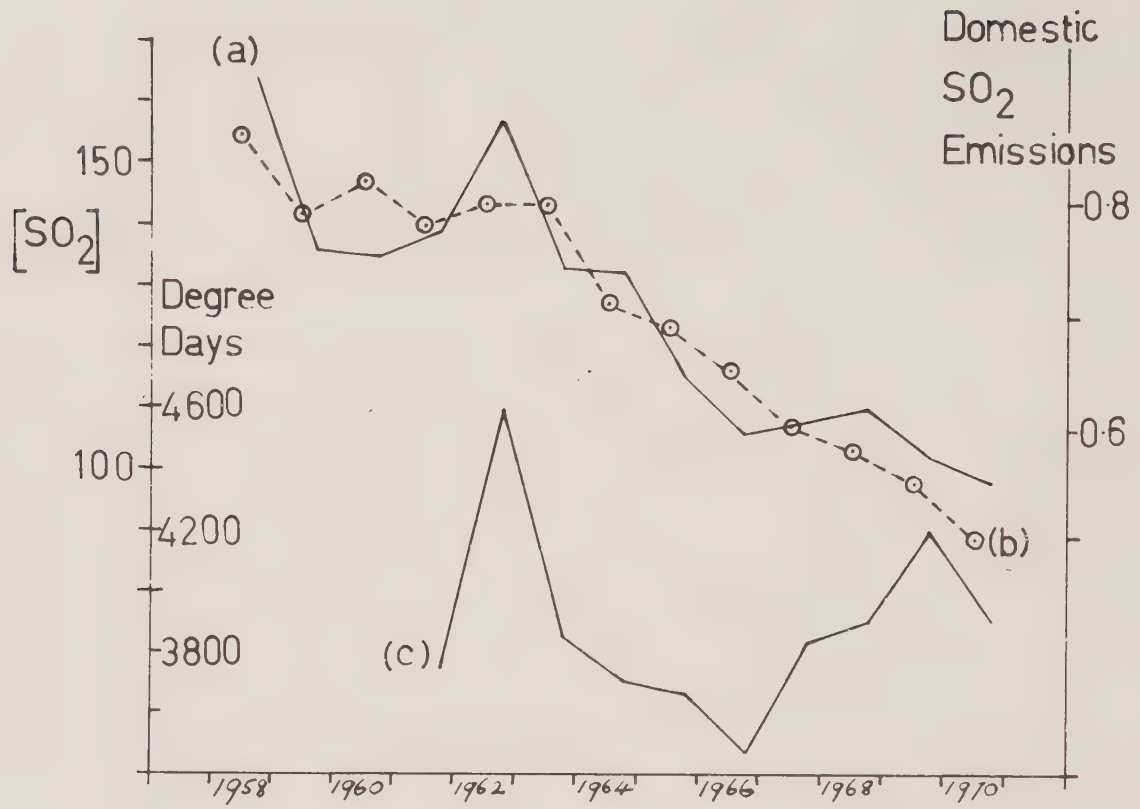

FIG. 3 (a) Urban average winter SO_2 levels in the UK (for pollution years ending March and plotted vs the mid-point for that year). (b) Annual domestic SO_2 emissions in the UK (million tonnes). (c) Thames Valley winter degree days. (Plotted vs the start of the winter).

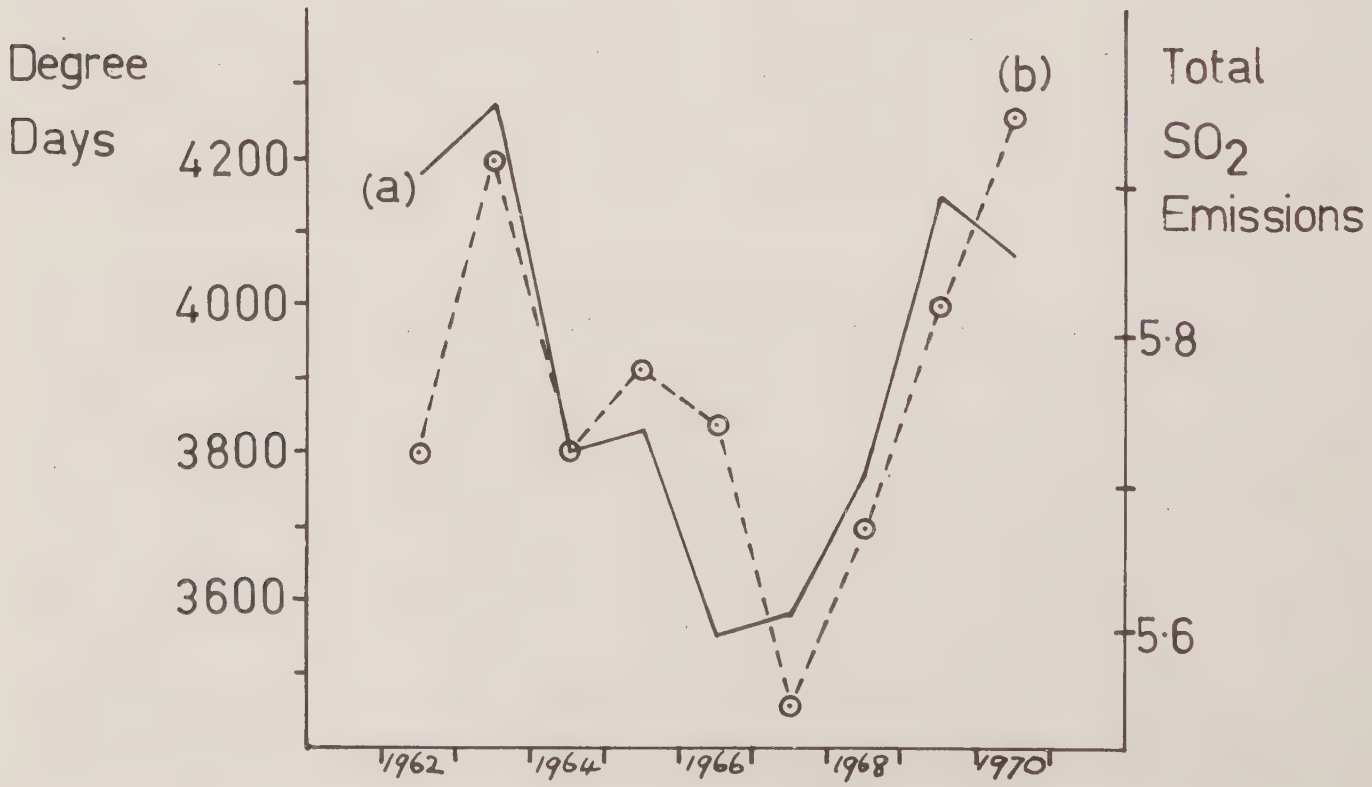

FIG. 4 (a) Thames Valley annual degree days. (b) *Total* UK annual SO_2 emissions (million tonnes).

meteorological conditions between consecutive seasons could give rise to as high as 10 or 35% changes in SO_2 levels, respectively, in extreme cases. So it is not easy to detect the effect of high level emissions at the ground level, when such large fluctuations may arise due to changing weather patterns. Indeed, Sutton[30] has pointed out the lack of sensitivity of previous methods, especially that used in ref. 26. The latest specific analysis of the effect of high level emissions on ground level concentrations[30] also finds a significant albeit small effect (less than 5% on average).

(ii) **Smoke.** Over the same period (1958/70), while domestic SO_2 emissions and SO_2 concentrations fell to about one half, the equivalent smoke quantities fell to about one third. Year to year fluctuations about the trend lines for both domestic emissions and concentrations were however very similar for smoke and SO_2, with one exception. This concerns the years from 1965 onwards. As can be seen in Fig. 3, the superimposed SO_2 concentration line fell below the domestic SO_2 emission line during 1965–6 and then rose above it again in 1967 and remained higher in the following years. Equivalent plots for smoke also show a rise in the concentrations line between 1966 and 1967, but only to just below the emissions line, where it then remained (see ref. 11, fig. 2.2). The rise referred to between 1966 and 1967 was explicable in terms of the degree of coldness of successive years and the comparable increase in total SO_2 emissions. Industrial emissions were the only other source of smoke, however, and these continued to fall after 1966. Hence total smoke emissions fell over this period and the explanation tendered for the rise in SO_2 levels is untenable in the case of smoke. Is there a contradiction?

Firstly, it must be realised that the lack of correlation of industrial smoke emissions with both the degree of coldness and monitored smoke levels does not necessarily indicate temperature and total fuel consumption to be unrelated for 1966–70. Falling industrial smoke emissions simply mean decreased use of coal by industry. Total industrial energy consumption data would be required to resolve the question of relationship between fuels usage and temperature over the years concerned.

Secondly, the smaller but related rise in concentrations relative to emission levels – for smoke (when compared with SO_2) – means that part of the relative rise in SO_2 concentrations was due to some factor(s) other than temperature and total fuels usage. Meteorological variables such as mean seasonal wind speeds, wind direction, etc. were likely factors. Whatever the causal factor(s) may have been, the following order-of-magnitude estimate utilises the common effect. Putting aside relative changes now, the absolute changes are examined between the 1965–6 and 1970 levels. For smoke, domestic plus industrial emissions fell by about 41% while concentrations fell by only approximately 30%. The 11% discrepancy may be attributed to the operation of the unknown factor(s). Over the same time span, SO_2 concentrations fell by 19%. If an 11% boost to SO_2 concentrations may also be assumed due to the operation of those same factor(s), an incipient decrease of 30% is implied in the SO_2 concentrations and the domestic plus industrial emissions.

In fact, domestic plus industrial emissions of SO_2 fell by about 6%; 24% less than expected. As there is only one remaining source of SO_2 we are led to the conclusion that about 24% of glc SO_2 may be derived from high level emissions from power stations.

It is necessary to point out that the above 'calculation' involves appreciable assumptions. For instance, it is assumed that the industrial sources of smoke and SO_2 were

similar (in that the proportions of chimneys at any height were equivalent), that the average meteorological conditions during smoke emissions were equivalent to those during SO_2 emissions, that the effect of equal changes in meteorological conditions would affect the dispersion of SO_2 and smoke in the same way, etc. The first two of these stated considerations are imponderables. As we have pointed out before, however,[7] the heavier smoke particles will be more likely to settle in unfavourable conditions than at, say, high wind speeds. There is no such consideration for SO_2 molecules, so adverse (low) wind speeds are likely to yield relatively higher levels of SO_2 than smoke. Hence on this account we may underestimate the contribution of power stations. On the other hand, an estimate of 24% does not seem at all unreasonable when compared with the percentages arising from refs. 26–30. Furthermore – *and most importantly* – refs. 26–30 are concerned only with the effects of high level emissions *within a few kilometres* of a measuring site.

What of the effect of high level emissions at greater distances? It is well enough known that SO_2 is transported beyond national boundaries. Surely then, quite large contributions to glc may be derived from high level emissions of SO_2 across the country? The ambient SO_2 inventory derived by Sutton near the Southampton neighbourhood included 30 ug m^{-3} of the total 39 glc (77%) due to drift from outside the area. (As Sutton has also mentioned, the mean drift level found in other studies at open rural sites in southeast England was 28 ug m^{-3}). What part of the drift and therefore what percentage of SO_2 glc is due to the high level emissions further away? Though the estimate of roughly 24% presented here may be subject to question on the basis of the inherent assumptions, at least it does address the question of the total contribution due to all high level emissions from power stations.

Finally, whether due to colder winters or not, the SO_2 glc did increase over the years that SO_2 emissions from power stations (and hence total SO_2 emissions) increased. The link between the source (high level emissions) and the observable effect on glc remains, whether the cause of higher power outputs was colder seasons, expanded industrial activity, a greater average degree of domestic comfort, or whatever.

Sulphur Dioxide Levels in the London Borough of Hillingdon

(i) **Winters, 1965/6–1975/6.** Referring back to Fig. 2(a) for average LBH, whole town winter SO_2 levels, during the four winters from 1968/9 and 1971/2, a major perturbation is observed relative to the baseline (winters 1965/6, 66/7, 67/8 and 1972/3 onwards) or the overall trend line. Inspection of Fig. 2(c) indicates an absence of correlation with temperature from 1965/6 through to 1975/6 and $p([SO_2],dd) = 0.155$. $p_{0.05} = 0.782$. This perturbation in winter SO_2 levels is not evident in winter smoke levels [(Fig. 2(b)] (but appears over the same period in the summer SO_2 levels [(Fig. 2(d))]. Prior to the introduction of smoke control, the absence of an equivalent feature in winter smoke levels would be taken to indicate the source to be non-domestic. However, in the vicinity of 1970 the same conclusion could not be drawn. On the other hand, the appearance of higher SO_2 levels in the intervening summers did suggest sources operative throughout the whole year: process industries, etc.

In an attempt to ascertain the generality or otherwise of this broad maximum in winter SO_2 levels in LBH, we have considered other sites. Plots of winter $[SO_2]$, 1958/9 to 1970/1, for all London monitoring stations are contained in figs. A4.7(a)–(h), in ref. 11

Extension of these plots up to and including the 1974/5 winter, yields the data in Table 1.

TABLE 1 Numbers of Greater London National Survey sites with winter SO_2 highs:no highs — by years and by regions

	LBH	*S,SW of City*	*City*	*Remainder*
1967/68	0:6 (0%)	13:4 (76%)	5:6 (45%)	17:50 (25%)
	LBH	*NW,W,SW of City—LBH*	*City*	*Remainder*
1968/69	6:1 (86%)	23:3 (89%)	8:4 (67%)	24:28 (46%)
	LBH			*Remainder*
1969/70	1:6 (14%)	—	—	20:60 (25%)
	LBH	*W of City—LBH*	*City*	*Remainder*
1970/71	6:1 (86%)	3:18 (14%)	1:8 (11%)	9:42 (18%)
	LBH			*Remainder*
1971/72	1.6 (14%)	—	—	16:52 (24%)
	LBH	*SW of City*	*City*	*Remainder*
1972/73	0:6 (0%)	5:2 (71%)	4:9 (31%)	4:45 (8%)

SO_2 levels decrease radially in all directions from central London[11]. Consequently, an airstream incoming to an outlying area from the central zone will give rise to increased SO_2 levels[7]. Bearing this in mind, the data of Table 1 indicate some or all of the high 1968/9 SO_2 levels to be due to a higher than normal incidence of winds from the NE, E and SE. For the 1970/71 winter, maxima in the SO_2 levels are almost universally observed in LBH whilst being uncommon everywhere else, thus suggesting some highly localised phenomenon. Conversely — given the small number of monitoring sites in LBH — peaks occur in about the same frequency as is generally the case for the winters of 1969/70, 1971/72 and 1972/73. However, in the instances of 1969/70 and 1971/72 the levels remain elevated relative to the baselines [see Fig. 2(a)]. Since the very high [SO_2] in 1970/71 appears to be due to local factor(s), it is possible the high levels of the adjacent three years are at least partly due to the same cause.

Combined with the indication of non-domestic sources, a survey of fuels usage by year-round consumers suggests itself. To this end, a list of all major employers in LBH was obtained. With the aid of the Chief Public Protection Officer, the list of 154 major employers could be reduced to 66 sites. Included were the Heathrow Airport complex, one large centrally air-conditioned shopping complex, Brunel University, three hospitals and numerous industrial establishments varying in size from small to massive, hereafter to be referred to as 'industry'. All major local industries had extensive records of types and quantities of fuels used for the previous 12 years and made this information available. Most of the remaining industries made their records available, although the information for early years (up to mid-sixties) was less complete and had sometimes to be guestimated relative to known levels of activities. In the case of the major users, %S in fuel oils and other petroleum products was obtained from the supplying companies, while for the remainder the average %S for SE England was taken as supplied by the

Institute of Petroleum. For coal, 1.3% S was assumed. (Ref. 11, Appendix A2). Figs. 5(a) and 6(a) depict the variations in 'industrial' SO_2 emissions for winters and summers, respectively. In each case the general pattern of variation parallels that observed in the monitored levels [Figs. 5(b) and 6(b)]. Since the plot of the monitored levels versus the 'industrial' emissions (em) for the winters [Fig. 7(a)] shows clear heteroscedacity, p was calculated rather than r. Correlation is very strong for the winters. Deleting the one outlier (encircled), $p([SO_2],em) = 0.903 > p_{0.01} = 0.794$.

From the survey data it is evident that the variations in industrial emissions are dominated by changes in volumes of the relatively sulphur-rich heavy fuel oil used by a few of the larger consumers in the area. A gradual build-up throughout the sixties, which flattened out for a couple of years, finally fell dramatically when some of the heavy users changed to the then recently available natural gas supplies.

(ii) **Summers, 1965–1975.** Discarding the two outlying points in the case of the summer data [Fig. 7(b)], $p(SO_2, em) = 0.786 > p_{0.05} = 0.738$; a weaker correlation in this case. Again the pattern of industrial emissions is the pattern of heavy fuel oil usage.

OTHER FACTORS IN SULPHUR DIOXIDE LEVELS, LBH

(i) **Winters, 1965/6–1975/6.** Immediately above, we have noted the strength of the correlation between monitored levels of SO_2 in LBH and industrial emissions in the area. Figs. 5(a) and (b) show this relationship and also the significant fluctuations of the monitored levels about the emissions plot. Possible causes for these fluctuations include the following:

I. Domestic emissions, due to changes in:
   - (a) population density
   - (b) the coldness of successive winters
   - (c) patterns of fuel usage including:
     - (i) sociological and/or economic factors such as increasing expectations of comfort, manifesting itself in heavier fuels usage and perhaps the use of more convenient fuels.
     - (ii) The availability of natural gas.

II. Meteorological variables may be different on average from one season to the next.
   - (a) Temperature [1.(b)]
   - (b) Wind direction
   - (c) Wind speed
   - (d) Atmospheric stability

We do not have data with respect to I(a). For I(b) [&II(a)] however, the poor correlation between winter degree days and monitored SO_2 levels during these years has already been noted. Inspection of Figs. 2(a) and (c) leaves little doubt about the apparent irrelevance of temperature over this period. Again, with respect to the possibility of increased fuels usage per head [I(c)(i)], we do not have any information. In the case of the usage of more convenient fuels [1.(c)(i)] and the availability of natural gas [I(c)(ii)], we do know conversion to have occurred over the years of 1969–71 and that the gradual increase in natural gas usage in the area[31] (Fig. 8(a)) is generally reflected by the fall in consumption of solid fuels[32] (Fig. 8(b)). For the coldest winter (1969/70), there is a localised maximum in the sales of solid fuels, as there is in domestic gas consumption and industrial SO_2 emissions. On the other hand, that winter has a

localised minimum in monitored SO_2. Overall, these plots of fuels usage are more or less as might be expected and fail to provide any insight to the fluctuations in monitored levels, relative to the industrial emissions. One incidental and puzzling relationship is the inverse one between domestic gas usage (relative to the baseline) and monitored levels between the winters of 1968/9 and 1975/6, inclusive. These inverse fluctuations in gas usage would make sense if they represented the exact opposite to consumption of a sulphur containing fuel; but this is not so.

External factors are indicated as a modifying influence upon the relationship between industrial emissions and monitored levels. The meteorological variables available[22] are those mentioned in II(b)—(d). In each instance the data was available on a frequency basis and it was necessary to compute a 'factor' which could be directly compared with pollutant concentrations.

Wind Direction Factor

The mean wind direction factor (wdf) was calculated from a summation of frequencies (fj) weighted by direction (j). Average SO_2 levels for each direction as determined for the 1975/6 winter[7] were used as the weightings (wj). Hence, $wdf = \sum_{j=1}^{8}(fjwj)/\sum_{j=1}^{8}fj$. (See Table 2).

TABLE 2. Mean SO_2 concentrations by incident wind direction for the 1975/6 winter and 1976 summer.

j	1	2	3	4	5	6	7	8
Direction	NE	E	SE	S	SW	W	NW	N
Wj (winter)	91	177	150	112	88	82	88	84
Wj (summer)	65	114	98	76	73	69	70	67

As is also the case with the other meteorological variables, there are innumerable ways in which a factor could be computed. Our choices have been for simple quantities with which correlation should be evident if significant correlation exists. Clearly the exact values of wj would vary from year to year. However, it is unlikely that the pronounced bias observed in 1975/6[7] would be greatly different in other seasons.

Fig. 5(c) is the plot of wdf vs season. Overall, the correlation between curves 5(b) and (c) can be seen not to be strong. For the period under consideration 1965/6—1974/5, $p(SO_2, wdf) = 0.345 \ll p_{0.05} = 0.648$. As the level of industrial SO_2 emissions (Fig. 5(a)) appears to be the primary determinant of the monitored SO_2 levels (Fig. 5(b)), we have also considered the variation of wdf with the ratio of monitored levels (b) to industrial emissions (a). However, this is little better: $p(b/a, wdf) = 0.367$.

Of particular interest though are the winters 1967/8, 68/9 and 69/70. Figs. 5(b) and (c) show identical behaviour which appears to be consistent with the information in Table 1. In fact, for 1967/8 the incidence of N and NE airstreams (wj large for S and SW boroughs) are average compared to the 1960/1—1974/5 means[22], whilst SW and W airstreams (low wj for S and SW boroughs) were of high incidence. On the other hand, for LBH it is relevant that E and SE winds (of particularly high wj) were of unusually

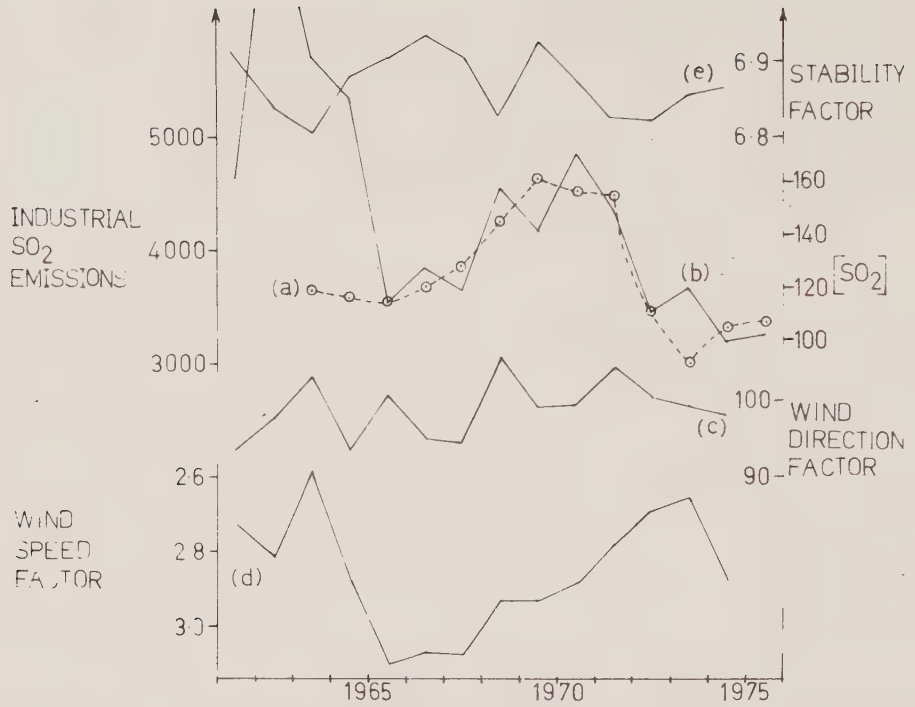

FIG. 5 Winters. (a) LBH "industrial" SO_2 emissions (tons). (b) Average monitored SO_2 levels in LBH. (c) Wind direction factor. (d) Wind speed factor (scale inverted). (e) Stability factor.

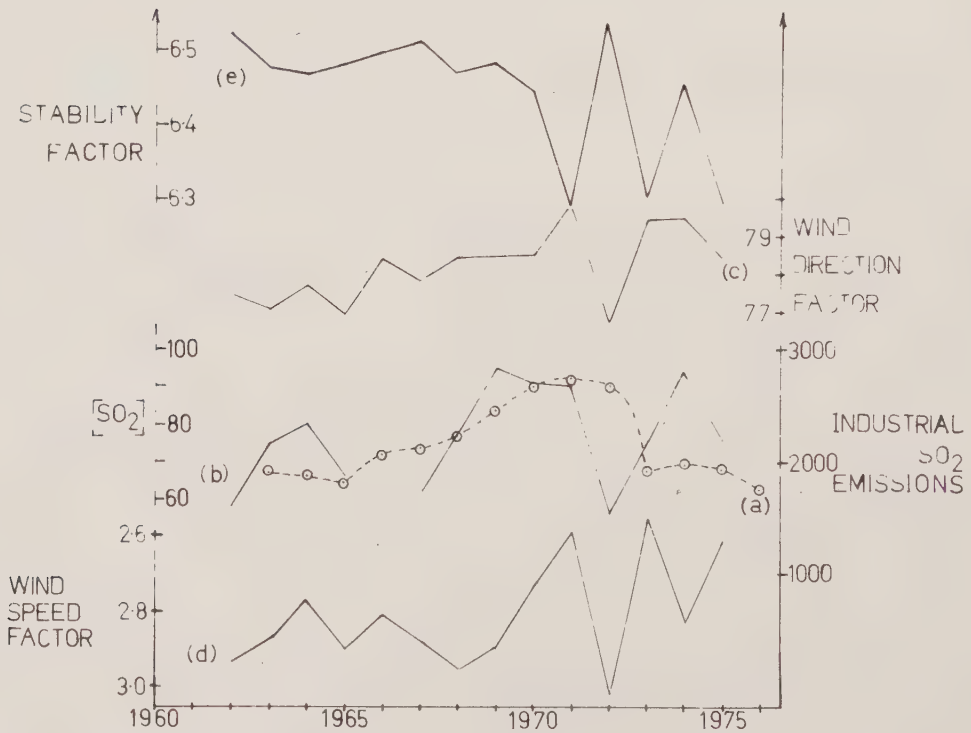

FIG. 6 Summers. (a) LBH "industrial" SO_2 emissions (tons). (b) Average monitored SO_2 levels in LBH. (c) Wind direction factor. (d) Wind speed factor (scale inverted). (e) Stability factor.

low frequency, being approximately 1½ and 2 standard deviations less than the 15 year average. By contrast, in 1968/9 there were unusually high frequencies of winds from the NE and N sectors; in each case the frequencies being slightly greater than 1 standard deviation above the 15 year mean. The winter of 1969/70 was a relatively normal year in terms of wind direction frequencies. Within the relatively featureless plot of LBH winter [smoke] a local maximum is also observed in 1968/9.

Wind Speed Factor

Frequencies were available from the Meteorological Office for wind speeds only in the categories 0–5. Hence for each winter the factor calculated was $wsf = {}^{5}_{i=0}(i.f_i)/{}^{5}_{i=0}f_i$ and negative correlations would be expected. We have therefore plotted wsf on an inverted scale (Fig. 5(d)). Generally, the correlation of $[SO_2]$ with wsf appears to be stronger than with wdf. For winters 1965/6–74/5, $p([SO_2],wsf) = 0.045$, indicating absence of correlation between these two variables and $p(^{b}/_{a},wsf) = 0.273$ also indicates a weak correlation at best. A plot of $[SO_2]$ vs wsf shows that the data fall into two distinct sets. These are 1972/3–74/5 for which the rank order coefficient $p(SO_2, wsf) = 1.000$ (note only 3 data points) and the previous period back to 1961/2 (the 1962/3 datum being quite divergent, as expected). For 1965/6–71/2, $p([SO_2], wsf) = -0.820 > p_{0.05}$. Looking at these two periods in isolation it is evident that the variation in wind speed is a significant factor. For 1965/6–71/2, the more often than not parallel variations between wsf and $[SO_2]$ no doubt lead to an over-estimation of the true strength of the cause and effect relationship between $[SO_2]$ and industrial emissions. A similar effect is obvious for 1962/3–64/5 correlation with temperature. The wsf varies in these years from the maximum value observed to the mean and thence to the minimum value. The correlation between $[SO_2]$ or [smoke] and the number of degree days over this period will consequently be enhanced. Between 1972/3 and 74/5, the behaviour of the wsf may go a long way to explaining the discrepancy between the $[SO_2]$ and levels of industrial emissions.

Stability Factor

Frequencies of occurrence according to the modified Pasquill stability categories (f_k) were weighted, then summed; $sf = {}^{9}_{k=1}(k.f_k)/{}^{9}_{k=1}f_k$. k=1 for the most highly unstable category, A, in which case dispersion should be best and pollutant concentrations least, k=2 for category A/B, 3 for B, ..., 7 for neutral conditions (category D), ..., and, k=9 for the most stable category F/G. In this last case dispersion should be worst. A positive correlation between $[SO_2]$ and sf is expected. Amazingly, the variations in $[SO_2]$ (Fig. 5(b)) about the industrial emissions (Fig. 5(a)) seem to be a *mirror image* of the behaviour of sf relative to its mean over the majority of the seasons. As was the case with wsf, correlation with $[SO_2]$ from 1965/6 to 74/5 is negligible ($p([SO_2],sf) = 0.030$), correlation with the ratio of $[SO_2]$ emission levels is weakly negative ($p(b/a,sf) = -0.200$), but the data fall into sets with respect to time; 1961/2–64/5, 1965/6–71/2 and 1972/3–4/5. $p(SO_2,sf)$ for these groups of years is respectively:

-0.800 for 4 seasons ($p_{0.1} = 0.900$ for 5 points, the least number for which p is tabulated), -0.536($p_{0.1}$=0.714 for 7 data pairs) and 0.000 for the last three seasons.

(ii) **Summers**

Equivalent data have been calculated for the summers and are presented in Fig. 6. Meaningful industrial SO_2 emission levels are available for 1963–76 and meteorological data from 1962–75. Reliable, monitored SO_2 levels in LBH were not available for 1966 so we have considered 1962–5 and 1967–75. For these thirteen years the correlation between coefficients $[SO_2]$ and the computed factors were:
$p([SO_2],wdf) = 0.760$, $p([SO_2],wsf) = -0.455$ and $p([SO_2],sf) = -0.591$. Critical values of p for 13 pairs of data are:
$p_{0.01} = 0.732$, $p_{0.02} = 0.669$, $p_{0.05} = 0.577$ and $p_{0.10} = 0.480$.

There is an extremely strong correlation with wdf; stronger in fact than with industrial emission levels (em) over the thirteen year period. A negative correlation with wsf is again observed, albeit not a strong one. Again puzzling is the significant negative correlation with the calculated stability factor (sf).

Apparently there were two major factors which influenced SO_2 levels in LBH during the period considered; the level of industrial emissions and the variations in the SO_2 load on the incoming airstreams. In the absence of information on domestic SO_2 emissions in LBH, it would appear that a maximum occurred in the ambient SO_2 levels between 1963–5 (and perhaps 1965–7?) due to a combination of significant fluctuations in both wind speed and wind direction. Between about 1970 and 1975 there were violent fluctuations in the average wind direction, wind speed and atmospheric stability which appear to give rise to large differences in the patterns of variation of the ambient SO_2 levels and the industrial emissions. In particular, the highest and lowest values of the three meteorological factors occurred between 1971 and 1973 and the marked disparity between the ambient SO_2 and industrial emissions levels in 1972 is clearly related to the wdf and wsf. Herein lies the explanation for one "outlying" point on Fig. 7(b). The other outlier is the 1974 datum, which is also within the period of wildly divergent average meteorological conditions. The significance of the stability factor is unclear.

SMOKE AND LOCAL COAL SALES

For the winters of 1966/7–75/6 inclusive, Figs. 2(b) and 8(d) indicate a high degree of correlation between smoke levels and local coal sales. $p(\text{smoke, coal}) = 0.858 > p_{0.01}$ (0.808).

CONCLUSIONS

(i) For the winters 1961/2–65/6 the primary determinant of SO_2 and smoke levels was the degree of coldness. The outstanding feature of this period was the exceptionally cold winter of 1962/3, in which pollutant levels were correspondingly high. During the later part of this period, there were also quite dramatic increases in the average seasonal wind speed which would have also contributed to falling SO_2 levels.

(ii) From 1965/6 through to 1975/6, the overall pattern of change in winter $[SO_2]$ was a reflection of a gradual building up in the consumption of high sulphur content fuels by industry within the Borough, followed by a sharp decrease due to the changeover to natural gas. Factors of secondary importance over this period were the direction from which the incoming windstream was derived and the mean wind speed. Over briefer periods, each of these factors can be seen to have a strong influence.

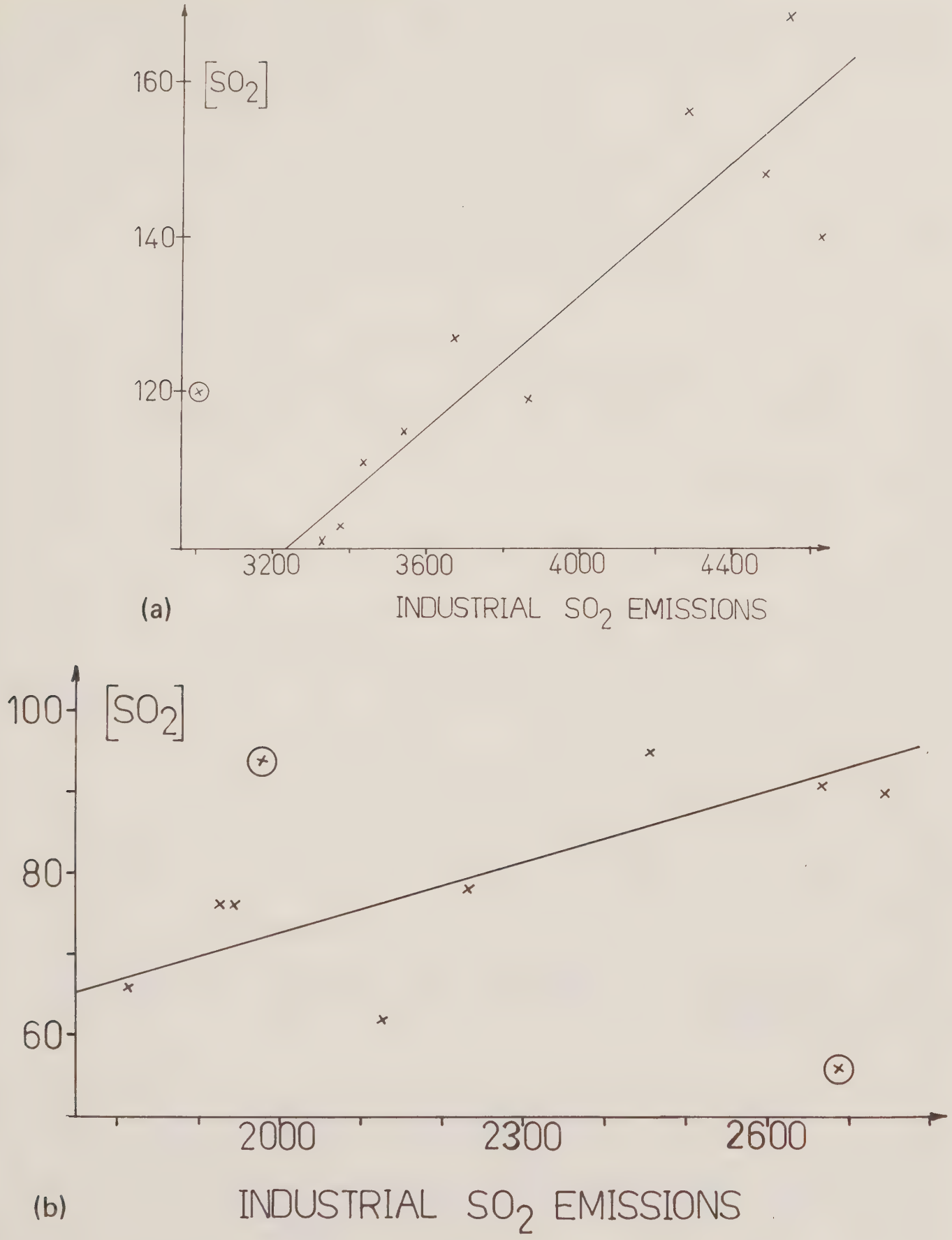

FIG. 7 Plots of LBH average seasonal SO_2 levels versus "industrial" emissions: (a) winters. (b) summers.

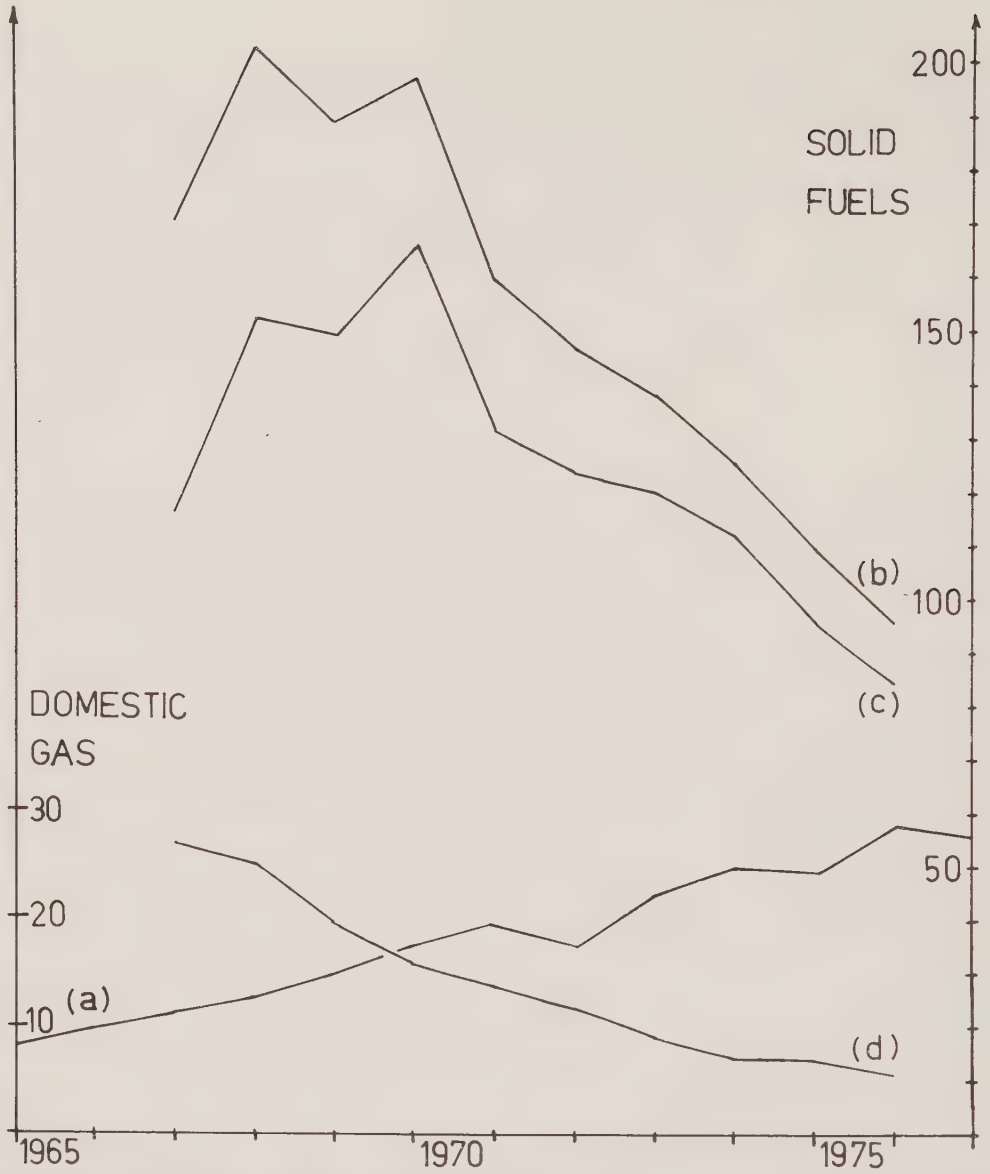

FIG. 8 (a) North Thames Gas domestic natural gas consumption in LBH (thousand therms). Sales of solid fuels from the West Drayton Coal Depot (thousand tons): (b) total, (c) smokeless and (d) coal.

NSCA WORKSHOP — TOWARDS AIR QUALITY MANAGEMENT, 26/27 March 1985

The Workshop provides a timely opportunity to update your knowledge of air quality monitoring and modelling, both now recognised to be essential management tools for industry, planning and regulatory bodies. Designed to highlight the range of techniques currently available, the programme includes three scene setting presentations — on the effects of emissions, the impact of EEC legislation, and future requirements for local/regional air quality assessment — followed by ½ day sessions on Industrial Emissions Monitoring, Air Quality Monitoring, and Air Quality Modelling. Examples of experience gained with various surveys and computer models will also be presented.

There is still time to register — use brochure enclosed with this issue!

(iii) Summer SO_2 levels between 1962 and 1975 were primarily determined by two causes; the SO_2 load on the incoming airstream (wind direction), and, for 1965–75, the level of industrial emissions. Again, variations in the mean seasonal windspeed appear to have a significant effect in some years.

(iv) As has been noted in other places[4,7], local concentrations of pollutants can be strongly dependent upon the load carried by the incoming airstream.

(v) Fluctuations in the mean, monitored, urban SO_2 concentrations about the domestic emissions line for the UK overall are seen to be related to the *total* SO_2 emissions and hence to high level emissions. An estimate of 24% has been made for the effect of emissions of power stations on SO_2 ground level concentrations.

ACKNOWLEDGEMENTS

The authors thank the London Borough of Hillingdon, Department of Public Protection, for their encouragement and assistance, all of the local industries for their co-operation in supplying fuels usage data, the Meteorological Office, Bracknell (in particular) the British Gas Corporation, North Thames Gas and West Drayton Coal Depot for the information provided.

RFC thanks Brunel University for its hospitality and Swinburne Institute of Technology for its generosity.

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BOOK REVIEWS

Airborne Sulphur Pollution — Effects and Control.
United Nations, Economic Commission for Europe, Air Pollution Studies 1
Report prepared within the framework of the Convention on Long-range Transboundary Air Pollution. Published by HMSO, January 1985, £18.05.

This publication contains studies and reports on the effects of sulphur compounds on the environment, carried out within the framework of the UN ECE Convention. The publication represents the state of knowledge current in about 1983.

The first part of the report examines the effects of sulphur compounds and other air pollutants on health and the environment, covering aquatic ecosystems, soils, groundwater and vegetation, materials, human health and visibility. Part II looks at technologies for controlling sulphur emissions and Part III, at cost benefit analysis of alternative programmes for sulphur emission control in the ECE region.

The expert groups contributing to this publication have reviewed the available literature and identified areas in which knowledge is lacking or inadequate, and in which further research is necessary. Plans for research projects on various topics are included.

While new knowledge has emerged since the studies on which this publication is based were completed, it does provide a very comprehensive overview of the subject, and an interesting insight into the work taking place under the Convention. Having decided initially that sulphur compounds should be given priority, it was soon recognised that while sulphur emissions are now at a standstill, nitrogen oxides emissions are increasing and that this trend is expected to continue both in the US and Europe. Hence, plans for future work on materials damage, for example, include assessment of the influence of nitrogen oxides and other pollutants, acting alone or in combination.

The report concludes that on the basis of present evidence, damage results not only from direct and episodic exposure to high concentrations of pollutants, but possibly also as a consequence of synergistic interactions or the impact of even very low concentrations. The report indicates that action is urgent in view of the growing evidence that insidious secondary effects are important elements in the fish kills and forestry dieback that have been observed.

The section on control options comes down in favour of developments in fluidised bed combustion, and supports a sensitive approach to controls according to the specific conditions prevailing in individual countries, in order to achieve an optimal combination of desulphurisation technologies.

The section on cost benefit analysis attempts to provide a detailed methodological basis for wide-ranging sulphur emission control. The approach adopted places emphasis on the uncertainty of scientific facts and the subjectivity of social valuations. This is crucial in an area where the uncertainties in benefits to be gained from controls are still great and the costs of those controls are very large. The development and proper

application of this type of approach might help to counter the arguments sometimes put forward for the postponement of sulphur oxides control on the grounds that further research is still required.

Other recent publications on acid rain are *Acid Rain* by Steve Elsworth, published by Pluto Press at £3.95 – a useful and readable account, if slightly over the top in places, and the Watt Committee on Energy Report, also entitled *Acid Rain,* price £14.80 – a careful literature review which explains scientific and technical concepts clearly but which contains no new observations to confound accepted wisdom on the subject.

Environmental Health Services – A Survey of Administrative and Legal Provisions
Edited by Robert B. Dean, pub. WHO, Copenhagen 1983.

This publication is the outcome of a survey of the wide ranging environmental health services in the WHO European regions. No two of these services are exactly alike, although one common feature of all the countries surveyed is that no one central organisation is totally responsible for the overall implementation of all elements of the national environmental health programme. The editor has found that as a result of insufficient co-ordination between the various arms of central and local government responsible for environmental health services in the various countries, there is no clear analysis of tasks and division of responsibilities: and this results in a loss of overall efficiency and a correspondingly low level of cost-effectiveness. For example, monitoring is frequently divided among various agencies, none of which has the overall responsibility for co-ordinating results or for setting standards. Only rarely are standards based on local conditions of exposure backed up by the biological monitoring of tissues and epidemiological surveillance. The trend is to rely on multinational (e.g. EEC) standards or guidelines employing a safety factor to cover local variations.

The reason for this dispersed authority lies in the gradual building up of environmental health services through various statutes over the years. Many agencies have been set up *ad hoc* to deal with identified problems and while some systems may be better than others, in the judgement of the editor, all are capable of improvement.

The report finds that air pollution services are especially fragmented, with pollution from factories governed by a different ministry than that responsible for pollution from motor vehicles (as is the case in the UK). Some countries, particularly concerned about the pollution of indoor air by e.g. tobacco smoking, regulate this via the authority responsible for health – in Sweden, the National Environmental Protection Board. In most countries, standards to be met are usually set by central government, and then the enforcement or administration is assigned to municipalities or other local government. In all cases, local government plays a major part in the control of noise.

After general observations, the report looks at 32 separate countries and then at the European Community and other international organisations in two separate chapters. There are some fascinating insights into little known areas of Europe including Albania and other Eastern Bloc countries, and Turkey. In each case the Government and basic legislation are described and then brief paragraphs deal with the control of water, air,

noise, solid and hazardous waste and radiation. The addresses printed at the end of each country's entry are particularly useful for those interested in following up the details of individual statutes or procedures.

Another interesting publication in the field is *Environmental Health in Europe 1983,* published by The Institution of Environmental Health Officers, 1984 (£5.00). It provides a succinct analysis of recent EEC action in areas linked to environmental health and pollution control and lists proposals for future EEC measures.

FUTURE EVENTS

12 MARCH – CONFERENCE "Industrial Pollution and the Community".
Organisers: Royal Society of Health/Society of Chemical Industry. To be held at SCI, 14/15 Belgrave Square, London SW1.
Fees: Members, RSH/SCI; £20, Non-members: £30
Details/Application form: Royal Society of Health, 13 Grosvenor Place, London SW1X 7EN.

26 – 27 MARCH – WORKSHOP "Towards Air Quality Management".
Organisers: National Society for Clean Air. To be held at Warwick University.
Fees: Residential – Members NSCA: £115 (+ VAT); Non-members: £129 (+ VAT)
Non residential – Members NSCA: £83 (+ VAT); Non-members: £97 (+ VAT)
Details/bookings: National Society for Clean Air, 136 North Street, Brighton BN1 1RG. Tel: 0273 26313.

16 APRIL – SEMINAR "Pollution Control – The European Dimension".
Organisers: South West Division, National Society for Clean Air. To be held at Bristol Polytechnic.
Fees (incl. lunch): NSCA members and students: £20; Others: £25
Details/bookings: Howard Nowell, Hon. Secretary, NSCA South West Division, Environmental Services Department, Abbey Chambers, Bath. Tel: Bath (0225) 61111.

21 – 26 APRIL – COURSE on "Oil Pollution Control"
Organiser: Warren Spring Laboratory/Institute of Petroleum. To be held at Orwell Moat House, Felixstowe, Suffolk.
Fee (including residence and meals): £645 (+ VAT)
Details/Application form: Conference Officer, Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR. Tel: 01-636 1004.

APRIL – SEMINAR on "Effect of Acid Rain on Buildings – Costs and Remedies".
Organisers: Surveying Unit (CPD).
Fee (incl. refreshments): £30
Details/bookings: Short Course Unit, Surveying Unit (CPD), Faculty of the Environment, PCL, 35 Marylebone Road, London NW1 5LS. Tel: 01-486 5811 ext. 284/328.

DIVISIONAL NEWS

NORTHERN DIVISION

Report on the meeting held in Durham, 30 November 1984

After the business meeting, a talk on "Living with Asbestos" was given by Dr. M.A. Harrison, MB, ChB, DIH, MFOM, Health and Safety Executive Medical Advisor. Dr. Harrison, who is well known in the North East as a member of the Employment Medical Advisory Service, gave a very interesting and fully descriptive talk on "Living with Asbestos". She started by informing the meeting that asbestos is not a modern material; indeed, the Romans had made use of it as a blanket for corpses before incineration. She showed that asbestos is found in natural situations and having a very strong chrysolite structure this has made its use eminently suitable for industrial and domestic purposes.

The first awareness that asbestos might constitute a health hazard was in a report presented around 1900. In 1907 Asbestosis was first described by Murray. The Factory Inspectorate undertook a review of the problem in 1930 following which the Asbestos Regulations, 1931, were produced.

Dr. Harrison said that mesothelioma was first reported in 1960; this indicated cause for concern and in 1969 new Regulations were produced which related to blue asbestos. Since then, there have been continual ongoing medical studies into the association of the material with certain cancers. 1983 saw the Stripping Regulations coming onto the statute book.

She then went on to define the three major forms of asbestos as in general usage, commencing with

Blue Asbestos (Crocidolite)
This is a short fibrous asbestos and has been extensively used. Because research has shown that this is the most troublesome form, there is now a ban on its use.

Brown Asbestos (Amosite)
Again this is a short fibrous asbestos used in sheeting, particularly corrugated sheeting, and is now recognised as presenting more of a problem than was at first felt.

White Asbestos (Crysotile)
A long fibrous asbestos used in asbestos rope and blanket manufacture.

The problem that arises from contact with asbestos fibres is the obstruction of lungs by fibrous tissue and association with lung cancer and/or T.B. The risk association is increased if the person is a smoker. The problems are more likely to occur after long exposure and obviously are dose-related.

Dr. Harrison was at great pains to emphasise the fact that asbestos is a good and useful

material, which plays an important part in structural and insulation work. It is unfortunate that some people feel that simply by being in a room where there is asbestos they are at risk.

She drew a comparison with death certificates showing the cause of death as being asbestosis or related diseases:

1969 – 78
1980 – 162
1969 – 159
1984 – 436

– Mesothelioma – and 55,000 deaths from heart conditions and 6,000 road deaths.

In conclusion, Dr. Harrison said that because of the public awareness of the potential problems when handling or removing asbestos, and the new Regulations which are intended to give a better and safer control of the removal of asbestos, we may have reached the peak in asbestos-related deaths. In her view, it is quite right that we should be concerned, but what one must avoid is causing panic situations whereby people feel that simply by being near asbestos they will have health problems. What we need to know is how to live with asbestos!

Her talk generated many questions which ranged from car brake pads and clutches to the problems which can arise through a change in structure when incinerating asbestos, and the quality of regulation control over the less than responsible firms when stripping out this material in the various situations.

Mr. Frank Sugden, MBE, retired Chief Environmental Health Officer, Middlesbrough Borough Council proposed a vote of thanks to Dr. Harrison. He was delighted to be asked to propose this vote of thanks having been a member of a Government Committee on Asbestos. He was concerned with the hysteria which has developed through pressure groups over the asbestos situation, and indeed, it was his view that mass removal of this material, particularly by unqualified, unsupervised operators could exacerbate the problem. He felt that the new Regulations, which controlled removal, if properly enforced, could prove of considerable help to all of us.

W.C.B. Robson
Hon. Secretary

YORKSHIRE & HUMBERSIDE DIVISION

Report on the Annual General Meeting, held in York on 26 June 1984

The AGM marked the end of an eventful year for the Division. As Secretary I shall not bore readers with details of events which included meetings with the National Farmers Union on Straw and Stubble Burning, presentations on lead, noise and on traffic pollution. I shall rather take this opportunity to send fraternal greetings from the Yorkshire & Humberside Division to all those members of the Society in other Divisions whose effort and work helps to promote the Society as one of the leading environmental groups in the Country.

In particular, I would wish to take this opportunity of acquainting other members of the Society with the retirement of one of the stalwarts of recent years, Bernard Twyford, whose retirement from Local Government life occurs this year. As members will know, Bernard was the Chairman of the Society and carried its flag through his year of office with the same dedication he has always shown to the Society.

The Division would also like to express its thanks to the staff at Brighton in this report for their assistance to the Division over the past and hopefully into the coming year.

Finally, the Division is convinced that we must continue to take an active campaigning stance on environmental issues with the same balanced reason that has always marked the Society's opinion. To this end, all Divisions must co-operate closely through the Brighton headquarters to ensure the Society continues as effectively in the difficult times ahead as it has in the difficult times just past.

David Bird
Secretary

EAST MIDLANDS DIVISION

REPORT OF A MEETING HELD AT SUTTON-IN-ASHFIELD ON THURSDAY, 6th SEPTEMBER 1984

Amongst the 60 people who assembled at the Devonshire Suite in the Idlewells Centre at Sutton in Ashfield on Thursday, 6th September 1984, were Councillor Len Poole BEM, JP, Chairman of the Council of the Society, Mr. D.F. Haynes MP for the Ashfield Division of Nottinghamshire and a Vice President of the Society, together with Cllr. R.S. Chamberlain JP in a triple capacity as Chairman of the Ashfield District Council, a Member of the Council of the Society and a member of the East Midlands Divisional Council.

Opening the meeting, Mr. John Marsh, Chairman of the Division welcomed in particular Cllr. Poole, whom he had asked to visit the East Midlands Division at a convenient time. Cllr. Chamberlain said he also wished to welcome Mr. Ian Mackay, the General Manager of the Solid Smokeless Fuels Federation who had moved headquarters from Wembley to Sutton in Ashfield.

Cllr. Chamberlain recalled that he had been on the Council of the Society for 9 years and on the Ashfield Council 20 years, 12 of which had been as Chairman of the Environmental Health Committee. Cllr. Chamberlain recalled also the smoke and the slag heaps which had characterised the area and the dense fogs produced in conjunction with the smoke of earlier years. That was now changed. Colliery buildings had been demolished, slag heaps grassed over and the railway, which formerly ran through the town centre, re-routed. There were now 7 collieries instead of twelve, new industry had been established and the economy of the district placed on a sounder footing. The proximity of the motorway made the area accessible. At present, Council staff were situated in three towns and it was hoped soon to make a start on Central Offices.

Cllr. Chamberlain was suitably thanked by Mr. Marsh, who then called upon Cllr. Len Poole to address the meeting.

Cllr. Poole said he was grateful for the invitation from Cllr. Chamberlain, who was a long standing colleague on the Council of the Society and he was also pleased to see Mr. Haynes, whom he knew worked extremely hard in his constituency. As Chairman of the Society, Cllr. Poole was trying to visit as many Divisions as possible and was pleased to find many of them so active. The Society had formed a new Noise Committee and Cllr. Poole expressed satisfaction that Mr. D.R. Romaine of the East Midlands Division had become a member. Referring in particular to Cllr. Chamberlain's part as Vice Chairman of the Conference and Promotions Committee in the arrangements for Conference, Cllr. Poole said that every effort was being made to maintain a balance and to encourage Local Authorities who were amongst the main supporters of the Society.

Mr. Haynes said he was pleased to be able to be present. It was difficult to attend regularly in view of Parliamentary commitments. Mr. Haynes recalled his long association with the cause of air pollution control and mentioned in particular the cleaning operations still in progress on the Houses of Parliament. Although not able to be regularly at meetings, Mr. Haynes assured members that he was doing whatever he could to make sure that money was available to continue the work of air pollution control.

The matter of stubble burning was raised during the business meeting by Cllr. J. Hall, who said that despite the new byelaws there had been problems in the Peterborough area. Mr. Marsh said that in Nottingham the position had been marginally better this year. Cllr. Poole emphasised the need to keep records and to inform the Society's HQ, so that if the problem persisted, there would be evidence for further approaches to government. A delegate from Corby reported that an organisation with which he was associated was investing in a machine to chop straw and plough it in. Referring to earlier remarks about farmers, a delegate from Fenland said their experience had not been that farmers were irresponsible. The fact was that even with controlled burning, there would still be smoke.

This concluded the opening speeches and also the business meeting. The Chairman then introduced Mr. Vincent Hale from the National Coal Board Marketing Department at Hobart House (Appliance Development Branch). Mr. Hale said that as Deputy Head of the Appliance Development Branch, he was concerned with the development and manufacture of solid fuel burning equipment. The Board pursued research themselves but also collaborated with industry and pursued the proposals to the market — hence the title of the talk, 'Solid Fuel and the Market Place'.

The Board also had considerable contact with the universities, Salford being a particular example. Annual investment by the NCB on Research and Development was 1—1.2m pounds per year and although much of this was spent on methods of burning coal to meet Clean Air Act requirements there was also work on solid smokeless fuel appliances both in relation to the people who wish to use them and the builders installing them.

Mr. Hale gave figures for sales of the various types of appliance in 1982/83 and showed slides of some of the latest appliances now in course of development. Other slides illustrated work in progress to provide precast and other factory made flues which could be easily and quickly installed in dwellings. Alternatives to stainless steel were also being evolved including pumice and a vacuum formed ceramic fibre. To enable experiments to be carried out freely the NCB, in conjunction with the Coal Merchants Federation, had built two small semi-detached houses. Mr. Hale also touched on woodburning appliances and indicated how much more efficient they were when burning solid smokeless fuel, as well as only requiring half the refuelling frequency.

Mr. Ian Mackay, General Manager of the Solid Smokeless Fuels Federation, said that the Federation was small but practical. Nationally, one of its main aims was the promotion of Solid Smokeless Fuels with local authorities in Clean Air work. Since coming to Sutton in Ashfield, he had seen a rapid increase in smoke control. Last year, the Federation had visited 65 Smoke Control Areas. This year, they were scheduled to visit 110. It was now much more practical to resume door to door visiting, since in the average Smoke Control Areas, there would be only 100-150 people burning coal.

Mr. Mackay referred to the association which the Federation had with the Society and the part played in that relationship by his predecessor, Mr. Harry Giblin. Mr. Mackay then invited his colleague, Mr. John Saunders, to show the Federation's Audio Visual.

At the conclusion of the morning's proceedings, all who had taken part were thanked by the Chairman. Mr. Marsh then indicated that there would be a pre-lunch sherry, kindly provided by the Chairman and members of the Ashfield District Council, followed by lunch for which we were indebted to the Solid Smokeless Fuels Federation.

After an excellent buffet lunch, one party of delegates visited the Rolls Royce establishment at Hucknall, whilst another party were received at the local Kodak Works.

Those visiting Rolls Royce were given a visual presentation of the testing facilities and some of the history of the establishment, but in particular, were introduced to the relatively new No 11 Test Facility which holds engines in suspension from a cantilever arm attached to a tall column and thus permits rotation to allow testing irrespective of wind direction. The whole of the facility is operated by remote control. After the presentation, members visited the actual facility.

The party visiting Kodak were shown the manufacture and loading of cassettes, the production of which numbers 100 million per year. The site was chosen for its high air quality and it is a tribute to the Smoke Control Programme in a coal producing area, that such stringent criteria could be met.

E.F. Raven
Hon. Secretary

The Editor regrets that it was impossible to include in this issue the interesting account of the East Midlands' AGM, held in Derby, June 1984; but see the NSCA Handbook for a report on the year's activities.

LONDON SOUTH EAST AND CENTRAL SOUTHERN DIVISION

The 29th Annual General Meeting of the Division was held on Wednesday, June 27th at Hobart House, HQ of the National Coal Board in London. Owing to disruptions in the British Rail Services numbers were smaller than expected but 19 delegates were in attendance.

The Chairman, Mrs. G. Naylor, welcomed Councillor L. Poole, Chairman of the National Council, the Secretary General and members of the Division.

After the business meeting Mr. Ian Mackay, General Manager of the Solid Smokeless Fuels Federation, gave a talk and an audio visual presentation on the latest appliances and progress on smoke control areas. He was followed by Nigel Haigh of the Institute for European Environmental Policy who spoke on "The Effect of the European Community's Air Pollution Legislation". The talk was most interesting and well received by the members. It covered the difficulties of setting acceptable air quality standards, acid rain, lead in petrol and other vehicle emissions, and how EEC legislation is implemented by the Community member states. There followed a stimulating session of questions, answers and comments.

The Chairman expressed her thanks to all the speakers and to the National Coal Board for the use of their facilities.

J.J. Beagle
Hon. Secretary

POLLUTION CONTROL – THE EUROPEAN DIMENSION

NSCA South West Division 1985 One-day Seminar

Tuesday 16 April at Bristol Polytechnic
Chairman: Max Beaumont

The theme of the South West Division's 1985 Seminar is the influence of the EEC on environmental pollution control in Britain. Presentations will cover wastes management (the Seveso Directive), environmental impact analysis, pollution monitoring, motor vehicle emission standards and emissions from large industrial plant.

In keeping with established practice, all papers will be presented by accomplished speakers who are leaders in their particular field of expertise. There will be ample time available for discussion. It is hoped to mount a small trade exhibition for perusal during break periods.

Fee (including lunch): £20 for NSCA members and students, £25 for others.

INTERNATIONAL NEWS
An IUAPPA Publication

JAPAN INVESTIGATES ACID RAIN

The Japanese Environment Agency has established a panel of experts to identify the mechanisms of acid rain and its effect on the environment. The panel is expected to report in 1988. The research project will examine rainwater from 14 sites throughout 7 prefectures, including Tokyo, Osaka and Hokkaido.

So far, acid rain research has assumed a rather low priority in Japan. Japanese soils are more capable of neutralising acidity than European and American soils, and the water system is very rapid, with underground water flowing to the sea more quickly in Japan than in other countries affected. However, the Environment Agency's National Institute for Environmental Studies has warned that the problem of acid rain is a global one, on a par with petrochemical pollution, and advises that the effects in Japan should be monitored before it is too late. To support this warning a recent survey conducted by Tokyo and nine neighbouring prefectures has revealed that Tokyo and areas to the north of the city are widely affected by acid rain.

SOUTH AFRICA

The Atmospheric Sciences Division of CSIR's National Physical Research Laboratory (NPRL), in collaboration with local authorities, has been carrying out nationwide monitoring of smoke and sulphur dioxide in the atmosphere over South Africa. Results show that air pollution concentrations declined by as much as 50% after smoke control regulations came into force in South African towns and cities. In some areas where concentrations are now rising again, municipalities are considering increasing the number of measuring stations to get a more comprehensive view of the problem. Stricter control measures might also be necessary.

Scientists studying air pollution are also looking into the problem of acid rain, using an ion-chromatograph to determine the concentrations of nitrates, sulphates and other ions in the atmosphere. Data acquired so far show that the highest daily sulphate values have on occasion reached the maximum allowable concentrations in California.

A correlation spectrometer used by the NPRL for preliminary surveys of the rate at which sulphur dioxide is released has revealed that smouldering coal mine waste heaps are a significant source of SO2. Previously, coal-burning power stations were thought to be the only source of such pollution. Other pollutants measured by the Laboratory (as part of a worldwide programme to measure pollutants which may influence the earth's climate) are trace gases, concentrations of Freon-11, and carbon dioxide.

(Source: *Scientiae,* Vol. 25 No. 2, April – June 1984).

EIRE

Air Quality in Ireland

An Foras Forbartha (The National Institute for Physical Planning and Construction Research) was in 1982 designated as Ireland's Air Pollution Data Base centre. Under this assignment, the Institute collects air pollution data obtained by local authorities from their monitoring networks and processes them on a regular basis (much as is done in the UK). These daily records of smoke and sulphur dioxide now cover a number of years, and in the case of Dublin stretch back to 1973. The computerised data base also contains climatological data. The data are used to assess air quality trends in certain areas of the country, particularly in relation to EC Air Quality directives, and are in part used for transmission to the Commission of the European Communities under the terms of the Decision on the Exchange of Information from air pollution monitoring networks. Now, Michael Bailey has produced a report on the present position on air quality in Ireland, which examines national atmospheric emissions, emissions in the Dublin area, air quality measurements and acid rain.

Domestic smoke

Until recently there has generally been little need for concern about air pollution problems in Ireland. It is a largely unpolluted country with plentiful supplies of air and water, and large areas of unspoilt landscape. Its total annual emissions of SO_2 are only about 1/30th of those in the UK and are thus probably of little international concern. On a regional scale, however, problems have recently emerged. In the capital, Dublin, there has been a significant increase in the use of solid fuel in the domestic sector and air quality has deteriorated. The introduction of natural gas into the area may improve air quality, but a significant improvement will depend on its widespread introduction in the domestic sector. That some improvement is very much needed is shown by the measurements of air quality in Dublin. Results from the winter of 1981/82 were particularly high, with 145 daily site smoke observations recorded greater than 250 *u*g/m3. The maximum daily smoke level recorded at any site was 1812 *u*g/m3, with very high levels of smoke being observed during an air pollution episode from 11 – 15 January 1982 when a ground-based inversion and low temperatures were recorded.

Acid Rain

Ireland rarely experiences significant acid deposition from sources in the rest of Europe, and there is no evidence to date of environmental damage in Ireland caused by long-range acid deposition. Any such effects are more likely to be due to local sources, especially in and around urban areas where damage to buildings may take place. Reserach is currently being undertaken by An Foras Forbartha to determine the significance of local and distant sources on acid deposition in the Dublin region. Although Ireland is, along with 24 other countries, a signatory to the Convention on Long Range Transboundary Air Pollution, Ireland's total emissions of SO_2 and NOx are very low in comparison to Europe's more industrialised countries. The recent EEC proposal for a Directive on the limitation of emissions of pollutants into the atmosphere from large combustion plant, which aims to bring about reductions of 60% in SO_2 and 40% in NOx emissions from those sources throughout the Community, would involve severe economic penalties for

Ireland, and any reduction achieved could not be expected to have a significant effect on levels of acid deposition in Europe.

Future needs

For the future, the report concludes that issues raised about long-range transportation of air pollution indicate the need for further development of national emission inventories. In Ireland at present these are available only for the country as a whole. A grid scale of, for example, 10 km^2 and for 1– 2 km^2 in urban areas would provide more detailed information.

The recent rapid urban expansion and industrial development are placing increasing pressures on the environment. As noted earlier, changes in fuel use offer a solution to the high smoke levels. A major challenge facing Ireland over the next decade will be to obtain a proper balance between economic growth and environmental quality, of which air pollution is an important aspect.

Air Quality in Ireland — The Present Position by M.L. Bailey, published by An Foras Forbartha, June 1984. £1.00.

INDOOR AIR POLLUTION

The European Parliament's Committee on the Environment, Public Health and Consumer Protection have turned their attention to indoor air pollution and possible hazards arising from the use of various types of insulation materials. The Committee has tabled two resolutions, the first referring mainly to illnesses which can be traced to air-conditioning systems, and the second to the potential health risks involved in the use of urea formaldehyde foam in insulation.

The first resolution concerns what is known as "humidifier fever" or "Monday morning sickness", which results from bacteria taken in from the air developing within the humidifier, and then being recirculated through the air-conditioning system. The condition is similar to allergy, in that foreign bodies are inhaled and stimulate the production of antibodies.

The second resolution, on the use of urea formaldehyde foam for house insulation, notes that this material has been banned in Canada since 1981 and the United States since 1982. The authors of the resolution call for a number of measures to be taken by the Commission of the European Communities, including a ban on the use of the foam "as soon as it has been proved that the product is in fact toxic".

The Commission of the European Communities has already proposed concerted action on "indoor air quality and its impact on man". Various topics are to be examined with respect to a variety of pollutants, among which formaldehyde is certain to be given some priority. The proposed action will consider indoor air quality in non-industrial spaces, but the European Parliament Committee wishes to see this scope extended to include the industrial environment.

FEDERAL REPUBLIC OF GERMANY

VDI Guidelines for Air Pollution Problems

The Commission on Air Pollution Prevention of the Association of German Engineers (VDI) has, for the past 25 years, been involved in drawing up Guidelines related to air pollution control. The Guidelines are worked out by experts from the fields of industry, science and administration, and serve as

decision-making tools for tackling problems concerning environmental protection. All the VDI loose-leaf Guidelines have now been combined to form the manual *Air Pollution Prevention;* they can also be bought individually, and those published since 1982 are available in both German and English.

The following areas are covered by guidelines:

1. formation and reduction of emissions.
2. transport of emissions in the atmosphere, determination of stack height, dispersion models, atmospheric chemistry;
3. effects of dust and gases on man, animals, plants and materials;
4. measurement techniques to judge emissions and immissions, measurement planning;
5. processes and plants for emission reduction, dust separation techniques, bill of costs.

The Guidelines belonging to group (1) describe the state-of-the-art in production plants and gas purification plants. These cover:

- descriptions of plant technologies, emission sources;
- technical feasibilities of emission reduction;
- indications of emission limits which can be adhered to on the basis of the state-of-the-art;
- advice on emission measurements.

All Guidelines can be obtained from: Beuth-Verlag GmbH, P.O. Box 1145, D 1000 Berlin 30, Federal Republic of Germany. Further information on particular Guidelines is available from: The VDI, Commission on Air Pollution Prevention, P.O. Box 1139, D 4000 Dusseldorf 1, Federal Republic of Germany.

FINLAND

Air Pollution Control News from the Finnish Air Pollution Prevention Society

The Air Pollution Control Act came into force in Finland on October 1st 1982. The Ministry of the Environment started its work one year later. The Air Pollution Control Act contains regulations on the general objectives and on the organisation of air pollution control as well as on the tasks of public authorities. The Council of State decides more exactly on the goals of air pollution control policy.

Activities in this field by the authorities and expert institutes are now underway. All eleven provincial governments and the Ministry of Environment have been given additional resources for the task. A division for air pollution control and noise abatement has been formed within the Environment Ministry, and an advisory Board for air pollution control has also also started its work.

The provincial governments can give special orders on emissions etc. for those plants that must submit their notification of air pollution control. The first notifications according to the Act have been submitted to the provincial governments, and the first decisions on these have been made. The notifications have concerned planned activities and some alterations to existing plants. The first group of existing plants that has to make notifications is major and middle-sized industry, and the deadline for these notifications was March 31st 1984. The next two groups of existing plants have one or two more years for the completion of their notification.

The usual local air protection authority is the municipal government. In many

instances the tasks have been transferred to municipal boards, often the board of health. There are plans to form special boards of environmental protection in the beginning of 1986. The municipalities have actively been applying for state grants for their most important task, air quality surveillance.

The Ministry has prepared and is continuing to prepare general guides for the work of the air protection authorities. In February 1984 guidelines concerning the notification procedure were published. In January 1983 the Council of State issued an order on the contents of gasoline. As of 1985, imported or produced gasoline may contain 0.15 grams lead per litre and 5 percent benzene at the most. The next step was that the Council of State this summer issued guidelines for sulphur dioxide, nitrogen dioxide, carbon monoxide and total suspended particulates.

At the same time as issuing air quality guidelines, the Council of State defined the long term goals of air quality policy: to protect conifers in wide forest and agricultural areas or nature conservation areas, annual sulphur dioxide levels outside towns and bigger villages should not be more than 25 $\mu g/m^3$, and to avoid acidification effects the total sulphur deposition should be under 0.5 g S/m^2.

The preparation of emission standards is continuing, both in the Advisory Boards for Air Pollution Control and in the Ministry. The work is based on the experience with Swedish recommendations and work conducted by the working group on industrial air pollution.

Air pollution from traffic has so far been dealt with according to international agreements, in particular those of the UN Economic Commission for Europe. The Nordic countries including Finland are, however, cooperating on these issues and aiming at targets that reach further than those comparatively modest ones of ECE.

This report on Finland's initiatives was written by *Eija Lumme,* Secretary, Finnish Air Pollution Prevention Society.

Finland's Air Pollution Guidelines:

Substances	Concentration	Time		
sulphur dioxide (SO_2)	40 $\mu g/m^3$	annual	arithmetic mean value	
	200 $\mu g/m^3$	1 d	98 % of values	200 $\mu g/m^3$
	500 $\mu g/m^3$	1 h	99 % of values	500 $\mu g/m^3$
total suspended particulates	60 $\mu g/m^3$	annual	arithmetic mean value	
	150 $\mu g/m^3$	1 d	98 % of values	150 $\mu g/m^3$
nitrogen dioxide (NO_2)	150 $\mu g/m^3$	1 d	98 % of values	150 $\mu g/m^3$
	300 $\mu g/m^3$	1 h	99 % of values	300 $\mu g/m^3$
carbon monoxide (CO)	10 mg/m^3	8 h	arithmetic mean value	
	30 mg/m^3	1 h	arithmetic mean value	

INDUSTRIAL NEWS

Babcock Power moves into European Smoke-Stack Emission Control Market

To meet increasing demands in Europe for equipment to control and reduce smoke-stack emissions causing pollution, Babcock Power Limited has signed a wide ranging technology deal with Japan.

Agreement has been reached with Hitachi Limited and Babcock's joint venture company Babcock-Hitachi KK to license three different technologies covering the reduction of emission of sulphur and nitrogen oxides from power stations, industrial boiler plants and other large pollutant emitting installations.

The agreement gives Babcock Power access to key areas of technology where Babcock-Hitachi KK has outstanding experience in both specialised equipment and plant installation and operation.

Since 1972 Babcock-Hitachi has been developing burners, combustion systems and operational techniques which have successfully reduced nitrogen oxide emission. Babcock Power, with full access to these developments, will thus be able to improve its existing technology.

The licences cover two additional technologies for the cleaning of power station flue gases. In Japan, Babcock-Hitachi has already commissioned 25 large DENOx systems for the removal of nitrogen oxides from power station flue gases by catalytic reduction to nitrogen and water vapour. A further 12 installations are under construction.

The agreement also gives Babcock Power access to the extensive experience Babcock-Hitachi has obtained in DESOx flue gas desulphurisation (FGD).

Reader Enquiry Service No. **8415**

Grade 2 Self-calibrating Noise Meter

The Cirrus Research design team have produced the first practical self-calibrating sound level meter to meet the new British Standard BS 5969 and the International IEC 651 both at Grade 2 industrial level. The CRL 2.21B has a new microphone which has been designed together with a high equivalent volume cavity to give the good accuracy and stability needed to meet the Grade 2 specification at all temperatures.

With a measuring range from 35 to 130 dB(A) the CRL 2.21B covers all industrial workplace levels and is also sensitive enough for factory boundary measurements as part of a "good neighbour" policy.

Three functions are provided: 'Slow' and 'Fast' as usual, plus the 'CAL' function. This produces a level of 94dB in the cavity and allows the CRL 2.21B to be checked for level accuracy. The range and the scale shape can also be checked by the 94dB level — a totally new feature.

Included in the low price of the CRL 2.21B is a useful carrying case with a pouch for the microphone, calibration screwdriver. pen, notes etc.. This makes the CRL 2.21B easier to handle and guards against accidental damage and shock.

Reader Enquiry Service No. **8416**

Diluting Stack Gas Sampler and Conditioner

Enviro-Technology, the air pollution specialists, have recently added the 797 Diluting Stack Gas Sampler to their product range.

Success or failure of an analysis system is often dependent on the design of the sampling system. The 797 overcomes the many problems traditionally associated with stack gas analysis and the unreliability and high maintenance cost of the instruments and associated components involved. By supplying a low dew point, clean, and dilute sample, ambient level analysers can be used giving the benefits of low long-term maintenance costs, minimal operating costs and very high reliability. The built-in flexibility of this system allows for ready adaptation to a wide variety of stack effluent conditions and compositions.

The 797 is a dry air (or gas) operated system which performs all the necessary functions to precisely prepare a stack gas sample for transportation and analysis. The sample is first filtered and then its flow precisely controlled by a critical orifice and a small ejector pump. The dilution air (or nitrogen) is used to create a partial vacuum in the ejector pump which extracts the sample. By rapidly diluting the small sample stream the sample dew point is reduced below that of the ambient air without condensation or causing unwanted changes in its chemical composition.

All these operations are carried out within the probe, thus allowing the metered, filtered and diluted sample to be transported under pressure to the analysers without the need for expensive and unreliable heated lines or pumps, etc. Sample and calibration gases are introduced at stack temperature and at the same point in the probe giving precise and total dynamic calibration of the whole system. The probe uses no electrical power and has no moving parts. The diluted sample volume is large, thus allowing simultaneous analysis of many components, with different analysers.

A range of easily interchangeable critical orifices are available which combined with adjustments in the dilution flow will give dilution ratios ranging from 12:1 to 350:1 allowing the use of high or low level analysers. Even higher dilution ratios can be obtained by cascading additional diluters so that 100,000:1 or more can be obtained which makes even olfactometry possible.

The 797 comes as a stand alone unit for customers with existing analysers or companies building stack gas monitoring systems. Alternately, Enviro Technology will provide it as part of a complete system utilizing instruments from their field proven highly reliable range of Ambient Air Quality Analysers. A system can consist of a single instrument through to a complete monitoring network with full data acquisition. The parameters that are regularly measured are SO_2, SOx, NO_2, NO, NOx, H_2S, NH_3, CO_2, Hydrocarbons, etc., but any suitable instruments can be incorporated in the system. An added advantage of using low level ambient instruments is that by disconnecting the dilutor, background low level measurements can also be taken. The system is also suitable for continuous on-line process gas sampling where harsh conditions are found.

Reader Enquiry Service No. **8417**